GAS JOURNAL

LIGHT ✂ HEAT ✂ POWER ✂ BYE-PRODUCTS

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Editorial Notes.

More Comparisons.

IT is obvious from the final sections of Mr. A. H. Barker's long report on the comparative costs of fuels for domestic purposes, published in later columns of this issue of the "JOURNAL," that, if ever his hope was realized in regard to the combined administration of gas, coke, and electricity, salesmen of the joint enterprise would be told to sell gas for cooking. In practically every respect gas is superior to electricity. Gas at 10d. a therm is half as costly as electricity at 1d. a unit. This is important, but still more important is the greater convenience of gas. Mr. Barker, throughout his trials, had three very competent cooks, and the principal difficulty which he experienced was in inducing these cooks to use electricity. "The exclusive use of electrical cooking apparatus has always been reluctantly undertaken, though for certain of the operations the electrical devices were preferred." The point we would emphasize is that, whenever a gas cooker was about, the cook was apt to transfer the heavy cooking work from electricity to gas; and it was only by cutting off the gas supply that Mr. Barker could arrive at his figures for the cost of electrical cooking.

One of the chief drawbacks of the electric cooker is its slowness; and, as Mr. Barker observes, "in a busy domestic establishment, rapidity is a matter of vital importance." The same thing, of course, applies to hotel and restaurant cooking. We were interested recently in reading, in an electrical newspaper, that to-day there are few first-class English hotels where the greater part of the cooking is not done on a large central coal range. "It is a characteristic of the greatest chefs of the world that, though they may be continually devising new recipes, yet, in the methods of cooking them, they like the ways of their grandfathers." It would seem from this quotation that many of the most famous hotels in London and the Provinces have poor chefs. The truth is, of course, that the majority of the best hotels are equipped with gas.

In this connection, we must refer to a report of the American Gas Association, which shows that chefs in the United States are as appreciative of the virtues of gas as are their confrères in this country. Chefs prefer gas to electricity because they can turn out their work faster and can enjoy a greater variety of temperatures under simple and easy control. In the report, examples are given of the replacement of electric apparatus by gas equipment. In an hotel in Chicago, for instance, where a complete set of electric cooking apparatus was installed at great first cost, gas appliances are now employed. Two years' experience demonstrated that electricity did not afford quick response to heavy calls; and since gas has been installed, not only have great economies been effected, but the chef states that he can now "get his orders out more quickly, and can obtain exactly the heat required at all times."

To return to Mr. Barker's report, two facets of the cooking problem demand emphasis. One is the reason why there is a heavy time lag with the electric oven; the other the comfort factor of gas cookery. Something untoward with an electric cooker, says Mr. Barker, "may "upset entirely the progress of important cooking operations such as the preparation of a festive dinner. The "thing is a mystery to her. One shock is sufficient to "frighten a nervous woman so much that she can hardly "be persuaded to use the apparatus at all. A gas burner, "on the other hand, is a perfectly straightforward appliance. The only thing liable to go wrong with it is that "it gets dirty, and if improperly used may go off with "a bang or make a smell; but with ordinary common "sense and a little bit of soda, the cook can keep it in "proper order."

Finally, attention is drawn to the fact that gas at 10d. costs half as much as electricity at 1d. for refrigeration.

A Typical Example of Progress.

WHEN applying to the whole industry figures of the growth of the gas business are so great that their very magnitude is apt to make it difficult for one to appreciate them. The case is, however, different with statistics relating to representative undertakings; and so the figures contained in the Presidential Address of Mr. A. Bird to the Midland Association of Gas Engineers and Managers fulfils a really useful purpose. The undertaking to which he devoted his address was that of which he has had charge for some thirty-five years—the Bromsgrove Gas-Works. This may be taken to be fairly representative of undertakings of that size; for the experiences of the Company are not likely to have been exceptional. Good, straightforward management has been their lot, as it is the lot of gas-works generally.

Under these favourable conditions, how gratifying has been the progress achieved. Glancing at the address, one sees that at the time when the undertaking was acquired as a going concern by the Company—*i.e.*, in 1869—the make of gas was 5 million c.ft. per annum, and that twenty-five years later, when Mr. Bird took charge, the output had increased to 20 millions. At the end of the following twenty years, the figure was 71 millions; while another fifteen years sufficed to bring the make to 133 millions. There are to be discerned here none of those signs of decay which certain persons profess to see—it must be when they are wearing special glasses.

On the contrary, with the passing of time and the change of circumstances, the rate of progress appears to accelerate, rather than otherwise. It is a heartening reflection; and if Mr. Bird's address had done nothing else than draw attention to this fact, it would have been well worth while.

It possesses, however, another very encouraging feature, in the statement that the Gas Company retain all the public lighting. Thus they have full opportunity of demonstrating the capabilities of gas, and so well do they take advantage of it that, with an immense volume of road traffic constantly passing through, satisfaction with the lighting is expressed alike by motorists and pedestrians. Mr. Bird is to be congratulated.

Hard Case of Monmouth.

There cannot fail to be a feeling of sympathy with the Directors of the Monmouth Gas and Water Company, Ltd., in a matter to which they have, by means of a circular-letter, drawn the attention of the inhabitants. The Town Council recently agreed to sell their electricity undertaking to the General Electric Company, Ltd.; and to one of the clauses in the lengthy agreement arrived at between the parties the Gas and Water Company quite naturally take exception. This clause, as appearing in the "Monmouthshire Beacon," reads:

> The borough will on all occasions possible promote the use of electrical energy in all its buildings, schools and works, and undertakings, and will assist the transferees in extending the use of electricity as aforementioned.

Such a stipulation as this would seem to stand in the way of that equality of treatment and opportunity for fair competition which the Gas and Water Company expect from the Municipal Authority. The Company point out that they are the largest ratepayers in the district, and that they work under statutory limits as to dividend and reserve, so that additional profits have to be utilized in reducing the price of gas. They think that, in the interest of the Company and their consumers, the clause quoted should be deleted; and in desiring its removal, they are merely conforming to the oft-repeated demand of the gas industry for a "fair field and no favour."

Ventilation of Gas Fires.

It is almost platitudinous to say that the success and the security of the gas industry largely depend upon the proper ventilation of gas-consuming apparatus. The problem is not by any means new; its consideration has been in the forefront of the industry's research policy for many years, but the fact remains that those outside our industry do not yet fully appreciate the necessity for providing adequate ventilation in modern homes. For this reason alone, the discussion on the subject by the Midland Association of Gas Engineers and Managers on Thursday last is more than welcome. The discussion was opened by Mr. R. J. Rogers, of the Birmingham Gas Department, than whom few can be more qualified to deal with the subject, for he has had invaluable practical experience of every phase of it. He treated many facets of the question, expressing his belief in the provision of flues to gas-fired wash-boilers, and urging study of the revised booklet of the National Gas Council on the ventilation of geysers. While all his observations are worthy of comment, and will be read with the keenest interest, we will confine our remarks here to the matter of gas fire ventilation.

Several times in these columns we have called attention to the virtues of "economy" gas fire flues—how, if they are properly designed and fitted, their use reduces building costs and conserves valuable space. Stress has also been laid—as it was by Mr. Rogers last Thursday—on the fact that they can be abused by skinflint builders, or by builders and architects who do not appreciate that such flues must perform the dual function of ventilating the room and entirely disposing of the products of combustion from the fire, and therefore should terminate above the eaves of the roof. Gas fire flues are a blessing if correctly fixed, and a curse if abused; and this should be borne in mind by the inspection staff of every gas undertaking. "Correctly fixed" implies that the circumstances fully warrant the adoption of flues of small area.

It may be remarked that the pros and cons of a small flue constitute a domestic problem for the industry, to which a non-elastic ruling cannot be applied; but when it comes to the disposal of products of combustion from a gas fire, there can be no two opinions about the advisability in building by-laws generally of incorporating clauses such as the two set-out by Mr. Rogers, which apply to the City of Birmingham. Another phase of gas fire ventilation (also of coke boiler ventilation) deserving of the closest attention is the provision of a pocket or extension of the flue below and at the back of the outlet on the fire, to prevent the flue outlet becoming choked by mortar, and so on, dropping down the chimney. Doubtless many of our readers saw the account of a fatal accident due to the blocked flue of an anthracite stove at Crewe last month.

Street Lighting by Gas.

"What the eye cannot see, &c.," means very little when the eye happens to be looking at street lighting; therefore, one is glad that gas undertakings are applying photometric tests to their lighting installations. Among these wide-awake concerns is the Huddersfield Gas Department, the staff of which prowl around at midnight with a modern lumeter, thereby ensuring that the illumination of the town provides at the same time safety for pedestrian and motorist and a first-class advertisement for gas. Naturally this is not the only manner in which the Department looks after its public lighting load; and much interest attaches to the description which Mr. Thorpe, the Chief Chemist, gives in later columns of our issue to-day of the care and skill exercised in every branch of the work.

As in every field of gas usage, it is axiomatic that good results can accrue only if the equipment employed is of the best. At Huddersfield, as will be gathered from Mr. Thorpe's contribution, nothing is left to chance. It is definitely a paying proposition to subject all raw materials to test, and the final results to general investigation and research. The author's observations and figures relating to the merits and demerits of mantles which appear identical are sufficient proof of the value of routine laboratory work. Though two mantles of similar size may look alike, they may be entirely different in properties. One may give a high initial illuminating power, but possess no wearing quality; another may give low initial illumination, but possess lasting qualities. Hence casual selection is of no avail—recognition of which accounts for the fact that only two mantles per nozzle are required every year for the street lighting of Huddersfield with a ten-month lighting season.

We have mentioned mantle selection only as an example of the manner in which the lighting problem is being tackled in this West Riding town. Even perfect equipment, however, can be misused; and what may be termed the second part of the contribution under review, which considers the correct employment of good apparatus, is even more important to the success of a lighting installation. In this connection the author's diagrams illustrating the distribution of illumination by light sources of different power and at different heights from ground-level are of great interest, particularly, we suggest, the diagram relating to the use of prismatic refractors. This shows the distribution of illumination along a 'bus and tram route; and the author explains that an increased mean illumination was obtained when refractors were installed, sufficient to raise the standard of lighting from Class E to Class D of the British Standard Specification, without having to increase the gas consumption per unit. Mr. Thorpe's practical account of what is being done and of what has been achieved at Huddersfield is both opportune and encouraging.

From Storm to Calm.

One of the items of news contained in last week's "JOURNAL" was of a peculiarly interesting character. We refer to that recording the annual meeting of the Maldon (Essex) Gas Light Company, Ltd., whereat it was revealed that an offer had been made by the British Gas Light Company, Ltd., to purchase the whole of the ordinary shares at the price of 16s. per share. This offer has become effective, inasmuch as it has been accepted by more than the required minimum of 90 p.ct. of the shares. This represents a remarkable transformation, on which all concerned are deserving of hearty congratulations; and we are pleased to note that in their report for the past year the Directors took the opportunity of expressing their appreciation of the assistance which they have received from the Consulting Engineer (Mr. W. W. Townsend, of Colchester), the Manager and Secretary (Mr. W. J. Mulley), and the employees, in "the difficult task of placing the Company in a better and more prosperous position than it occupied a few years ago, when the financial condition was somewhat uncertain, and the ordinary shares of very little market value."

Mechanization.

The introduction of the loose leaf bank passbook and the use of machines in connection with the preparation of gas accounts are only two of the indications of changing conditions in certain branches of work. Reference is made to the matter, in their report for 1929, by the Headmasters' Employment Committee in connection with the Public Secondary Schools, who say: "There appears to be a growing tendency on the part of commercial and industrial firms to open their doors to the better type of boy of about 18 years, to whom they offer a career in salesmanship or in executive work. This is gratifying, and may be due in a measure to the interest which has lately been manifested by the public and the Press in the question of salesmanship at home and abroad. Mechanization is also having its effect. For instance, the number of boys placed in banks shows a decrease of 20 p.ct., as compared with the figure for the previous year. In addition to certain of the 'Big Five,' some of the private banks are introducing machinery, and we are told that in future fewer and better entrants will be required. Insurance companies are unlikely to instal machines to the same extent as the banks. Mechanization has also been adopted by at least one very large public utility company."

Inefficient Street Lighting.

On more than one occasion recently attention has been drawn in the columns of the "JOURNAL" to comments made at inquiries into motor fatalities regarding inadequacy of public lighting in relevant situations. Another instance has been provided by the West Riding Coroner, who, when inquiring at Batley into the death of a man who had been killed at night by a motor van, suggested that lighting authorities generally should consider whether a better method of street lighting is not available. It was stated by a witness that the street lamps at the scene of the mishap were fitted with shades that had the effect of casting shadows on the road, leaving spaces that were more or less without light. The Coroner remarked that this was not peculiar to the roads of that district. In many instances, the conditions were such that if one crossed the road at night one did so at one's peril. We agree with the Coroner that it is about time something was done to improve the lighting of many of the roads, and hope that good will come of his suggestion that the whole question of street lighting should be reviewed by the authorities. Gas is available practically everywhere, and forms an ideal street illuminant. Its virtues in this respect must be kept to the fore.

British Industries Fair.—More than 200,000 visited the B.I.F. at Olympia this year. The total compared with 147,000 last year. Trade buyers from home and overseas accounted for about 155,000 of the attendance, the rest being the general public

Personal.

Mr. J. R. WILLIS ALEXANDER, Secretary of the Institution of Gas Engineers, is the Master-Elect of the Ardingly College Masonic Lodge, No. 4410.

Mr. W. A. BARNETT, Works Manager to the Barnet District Gas and Water Company, who was admitted as an Associate Member of the Institution of Chemical Engineers in January last, was on Feb. 21 elected an Associate Member of the Institution of Mechanical Engineers.

Mr. THOMAS PARSONS, Chairman of Directors of the Yeadon and Guiseley Gas Company (of which the Engineer and Manager is Mr. J. Lister Cooper), has been presented with an inscribed timepiece, the gift of his fellow Directors, to mark their appreciation of his many years' service to the Company. Mr. Parsons, who is 77 years of age, has been a Director of the Company for 35 years, and Chairman for the past four years. The works have been rebuilt three times during his period of Directorship. When he first became associated with the Company, the annual output of gas was 50 million c.ft., whereas now it is 155 millions.

The Horstmann Gear Company, Ltd., of Bath, have appointed Mr. E. GLOVER CLARK as their North of England representative.

Forthcoming Engagements.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

March 15.—MIDLAND JUNIOR GAS ASSOCIATION.—Visit to the works of Messrs. Bryan Donkin Co., Ltd., Chesterfield.

March 15.—WALES AND MONMOUTHSHIRE JUNIOR GAS ASSOCIATION.—Meeting in Cardiff. Mr. T. H. Madden on "Mechanical Handling of Coke."

March 19.—BRITISH COMMERCIAL GAS ASSOCIATION.—Executive Committee, London.

March 20.—BRITISH COMMERCIAL GAS ASSOCIATION.—Annual Meeting of Members in the Midlands, Grand Hotel, Birmingham.

March 20.—BRITISH COMMERCIAL GAS ASSOCIATION.—Annual meeting of members in the Southern District, at 28, Grosvenor Gardens, S.W. 1, 2.15 p.m.

March 21.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute. Paper by Dr. H. T. Angus, Ph.D., M.Sc., on "Gas Cooker Oven Ventilation and Hotplate Burner Efficiency."

March 22.—MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.—Joint visit with Yorkshire Junior Gas Association to Messrs. West's Gas Improvement Co., Ltd., and City Justices Meter Testing Station, Manchester.

March 22.—YORKSHIRE JUNIOR GAS ASSOCIATION.—See Manchester Junior Association.

March 22.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Visit to Bussey Coal Distillation Co., Ltd., Glenboig.

March 22.—WESTERN JUNIOR GAS ASSOCIATION.—Meeting in Bristol. Paper by Mr. S. B. Jones, of Clevedon, on "Coal Testing."

March 25.—MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.—Sixtieth Annual Meeting, Midland Hotel, Manchester, 11 a.m. Luncheon to celebrate Diamond Jubilee of the Institution.

March 28.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Annual General Meeting at the Hotel Cecil, Strand, W.C. 2, 2.15 p.m.

April 11.—NORTH BRITISH ASSOCIATION OF GAS MANAGERS.—Spring meeting at Helensburgh.

April 26.—WESTERN JUNIOR GAS ASSOCIATION.—President's Day. Visit to the Weston-super-Mare Gas-Works, and Annual Meeting.

May 2.—NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.—Annual General Meeting in Newcastle.

May 16.—SOCIETY OF BRITISH GAS INDUSTRIES.—Annual General Meeting, Hotel Metropole, W.C. 1. Annual dinner in the evening.

June 2-5.—INSTITUTION OF GAS ENGINEERS.—Annual Conference in Leeds.

"B.E.S.A." Charter Banquet.—Mr. John Terrace (immediate Past-President) and Mr. J. R. Willis Alexander (Secretary) represented the Institution of Gas Engineers at the Banquet held at the Grocers' Hall in the City of London, to celebrate the grant of a Royal Charter of Incorporation to the British Engineering Standards Association. His Royal Highness the Duke of York was the Principal Guest, and proposed the toast of the Association.

In To-Day's "Journal."

William Cartwright Holmes Scholarship.

In our advertisement columns, attention is drawn to the eligibility for this scholarship of graduates or other senior applicants of suitable training who desire to take a one-year or two-year course in Gas Engineering, as provided in the Regulations of the University of Leeds for the Diploma or Honours Degree in Gas Engineering. The value of the scholarship is £170 per annum, and is competitive.

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Cost of Fuels for Domestic Purposes.

Mr. A. H. Barker's report on this subject, presented at the Joint Gas Conference in Birmingham, is concluded. He deals with gas and electricity for cooking and for refrigeration, showing that, with gas at 10d. a therm and electricity at 1d. a unit, cooking by gas costs half as much as it does by electricity. The main practical advantage of gas is the speed at which the cooking can be carried out. At the end of his report, Mr. Barker states: "I am looking forward to the time when there shall not be a separate electricity supply authority and a gas supply undertaking and coke merchant in one area, but that all shall be parts of the same amalgamated company, and that all members of the staff shall be equally trained in the proper use of all, that the waste and spare products of the gas-works shall be used to generate the electric supply, and that all the resources of the company shall be combined not only to make a profit for the shareholders, but to serve the customer with cheap gas, cheap electricity, and cheap coke—all of which should be carried to every house. We hear much in these days about the advantages of what is called rationalization of industry. I venture to say that there is no single example in the whole of industry where the advantages of that process would be so conspicuous as in this."

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Gas for Street Lighting.

Mr. B. Thorpe, Chief Chemist to the Huddersfield Gas Department, describes what is being done in this West Riding town to ensure that the public lighting shall provide safety to pedestrian and motorist and at the same time a good advertisement for gas.

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Improvements in Lip-Bucket Conveyors.

The introduction of the West lip-bucket conveyor has made demands on the chain which have only been successfully met by improvements in the details of the design and in the materials and methods used in its manufacture. It is claimed that, as a result of recent improvements: The lubrication of the running wheels is internal; the journal is not exposed to the action of coke dust; the hardened surface of the journal (on the bush) makes for long life; the wearing surface is proportionately very large; the bush is readily renewed; and the stamped links are relieved of all wear and tear, and practically never require renewal.

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Problems in Coal Cleaning.

This subject is discovered by Dr. F. S. Sinnatt and Mr. D. T. Davies. The authors say: "It has been observed that Great Britain has lagged behind the Continent in the application of methods of coal cleaning. This is not a correct view of the situation. The coals of Great Britain are found in seams which are usually extremely pure and free from ash. The result has been that the application of cleaning processes in the past has not been so necessary as on the Continent, where the coals are less pure. The proportions of the types of coal required by industrial concerns are gradually changing. The methods used in the mines for the removal of small coal are increasing in efficiency, and thinner seams have to be worked. These facts have brought about a greater application of coal cleaning. It is clear from the statistics that the coal industry, especially in certain of the coal areas, has fully appreciated the situation, and is taking adequate steps to meet present-day and future requirements."

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Sir Arthur Duckham on Co-Partnership.

At a luncheon of the Industrial Co-Partnership Association at the Holborn Restaurant on Thursday last, Sir Arthur Duckham, G.B.E., K.C.B., gave his views on co-partnership. The gas industry, he said, is an example to all industries in this country, in that, for over a generation, there has been no major trouble in the industry. Co-partnership and profit sharing are general. There is a different feeling among all gas employees in whatever sphere they may serve, than among employees in any other industry in this country.

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Gas Salesmen's Circles.

In his Presidential Address before the Midland Association of Gas Engineers and Managers, Mr. A. Bird, Engineer and Secretary to the Bromsgrove Gas Company, said: "Salesmen, whatever title they may be given, are the real live connection between the gas supplier and its public, and much of the success of an undertaking depends upon the impression they make upon the minds of their patrons. The Gas Salesmen's Circles have made excellent progress since their inception, and are destined, in my opinion, to give a still better account of this branch of gas service in the near future, particularly if they are fostered to the extent their importance warrants."

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Ventilation of Gas Appliances.

This matter was considered by the Midland Association of Gas Engineers and Managers. The discussion was opened by Mr. R. J. Rogers, of the Birmingham Gas Department, who explained that the following clause had been included in the Building By-Laws of the City of Birmingham.

> Every person who shall erect a new domestic building and shall, for the purpose of heating any habitable room therein, provide a gas fire or other similar apparatus shall, for the purpose of securing the ventilation of such room, construct an adequate flue in connection with such gas fire or apparatus to discharge above the roof by means of a chimney or other suitable outlet.

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Fuel Research Board Report.

Fuel Research Technical Paper No. 24, "The Assay of Coal for Carbonization Purposes (Part III.)—Correlation with Coal Gas Manufacture," is reviewed.

A Fine Advertising Achievement.

What may well be described as a masterpiece in brochure production has been achieved by Messrs. R. & A. Main, Ltd., in their new season's cooker catalogue. The progress which has been made in the perfecting of Main gas cookers in recent years is portrayed throughout the brochure—progress which has involved a great deal of research and experiment not apparent to those who see only the finished goods. The fruits of this work are the appliances shown in the pages of the catalogue. Every type of Main cooker, with complete specifications as to size, finish, &c., has its place, while particular attention is paid to the fittings, brasswork, and enamelling. The "Conservor" oven is fully explained, together with details of the "Mainstat" automatic cooking control, which is now a regular feature of all the higher-grade cooking installations. The high-level cooking range is also dealt with, and different designs of hotplates and smaller grillers and gas rings receive attention. A final section indicates some of the firm's latest types of wash-boiler. The crowning achievements of the production, perhaps, are the beautiful designs of the front cover and the centre-spread. The latter shows a "Deluxe" model cooker, in actual colours, with a background of Wedgwood ware in an exceedingly artistic layout. The front cover depicts in most attractive style and colouring further examples of this beautiful ware. The reason for the theme of these colour plates is that this year marks the bi-centenary of the creator of this English pottery—Josiah Wedgwood (1730-1795). Wedgwood's love for his craft made him so exacting, it is said, that he would ruthlessly destroy any of his work which did not quite reach the high standard he set himself—an example which Messrs. R. & A. Main, Ltd., are emulating in their enterprise, research, and the exacting standard of their manufacture.

Ex-Service Men Entertain Their Colleagues at East Greenwich.—Over seven hundred members of the Old Comrades' Association of the South Metropolitan Gas Company were entertained at a concert on Thursday, March 6, at the Co-partnership Institute, East Greenwich, by the ex-service "Roosters" party. It was a memorable evening by reason of both the quality of the entertainment and the size of the gathering. The Old Comrades' Association of "South Met." Gasmen was formed in 1927, and it has now a membership of 1500, being the largest of its kind in the country. Invaluable work is done in assisting members in times of difficulty, sickness, accident, &c., and also in keeping alive the spirit of real comradeship that existed during the war.

Correspondence.

Residual Products and their Effect Upon the Price of Gas.

SIR,—In his paper "Residual Products and their Effect upon the Price of Gas" read at the Joint Gas Conference (see "JOURNAL" for Feb. 19, p. 502), Mr. W. B. McLusky shows, by Chart No. 4, that since the year 1916 the receipts from the sale of coke have had a greatly increased influence upon the net cost of coal. It is doubtful, however, whether the lowest net cost of coal determined without taking into consideration the gas sold per ton will necessarily produce the cheapest gas. There may be circumstances when it would be more remunerative to work to a method not showing the lowest figure for the net cost of coal, arrived at by only deducting the value of the residuals from the gross cost.

The market price of coke, considered in conjunction with the gross cost of coal, will show whether it will pay better to dispose of the coke in the solid or the gaseous form. There is no doubt that if every gas undertaking put the whole of their production of coke on the market, the price would fall to such an extent that coke would soon be in the same position that ammonia is at the present time.

Figures bearing upon these remarks were prepared by me for Mr. Botley, who intended them to be utilized as a written contribution to the discussion on Mr. McLusky's paper. As, however, they were not read, he has asked me to include them in a modified form, to show the experience at Hastings, in regard to the effect the sale of gas and residuals had upon the cost of manufacturing gas during four weeks in January 1929 and 1930.

Figures Relating to the Net Cost of Coal at Hastings for Four Weeks in January, 1929 and 1930.

Year.	Coal Carbonized.	Coke Sold to Customers.	Coke Used in C.W.G. Plant.	Output of Gas.	Oil Used.
	Tons.	Tons.	Tons.	1000 C.Ft.	Galls.
1929. .	2670	613	433	58,234	39,222
1930. .	3201	1156	196	52,104	10,959

Cost of Coal "A."

1929.	£ s. d.	Pence per 1000 C.Ft.	1930.	£ s. d.	Pence per 1000 C.Ft.
Coal carbonized—			Coal carbonized—		
2670 tons at 26s. 9d.	3571 2 6	14·71	3201 tons at 26s. 9d.	4281 6 9	19·72
Less tar recovered—			Less tar recovered—		
10 galls. per ton at 3d.	333 15 0		10 galls. per ton at 3d.	400 2 6	
	£3237 7 6			£3881 4 3	
Less coke sold to customers—			Less coke sold to customers—		
613 tons at 26s. 2d. (4·59 cwt. per ton of coal) . . .	802 0 2		1156 tons at 26s. 2d. (7·22 cwt. per ton of coal) . . .	1512 8 8	
Net cost of coal, 18s. 3·6d. per ton . .	£2435 7 4	10·03	Net cost of coal, 14s. 9·6d. per ton . .	£2368 15 7	10·91
Net cost = 68·1 p.ct. of original cost			Net cost = 55·3 p.ct. of original cost		

SALE OF GAS AND RESIDUALS.

The gas sold in January, 1929, was approximately 58,234,000 c.ft., less 6 p.ct. allowance for gas used on works and unaccounted-for, which brings the quantity sold to 54,740,000 c.ft., which, at 460 B.Th.U. per c.ft., represents 251,804 therms. The sale in 1930 on the same basis was 225,298 therms.

Taking an average value of 10d. per therm for the gas and 26s. 2d. per ton as the sale price of coke, the revenue on the foregoing figures is as shown by "A."

The greater gross profit for the 28 days in January, 1929, is due to the additional therms sold during that period. If the two methods be compared when the gaseous output is equal, then 1930 has the advantage, the figures being as "B."

At the same make per ton, the coal used will be 2389 tons and the oil in C.W.G. plant 35,094 gallons.

Revenue "A."

1929.	£ s. d.	1930.	£ s. d.
Gas sold—		Gas sold—	
251,804 therms at 10d.	10,491 16 8	225,298 therms at 10d.	9,387 8 4
Coke sold to customers—		Coke sold to customers—	
613 tons at 26s. 2d. .	802 0 2	1156 tons at 26s. 2d. .	1,512 8 8
	£11,293 16 10		£10,899 17 0
Less oil used—		Less oil used—	
39,222 galls. at 4¼d. (less value of the tar)	621 0 4	10,959 galls. at 4¼d. (less value of the tar)	173 10 6
	£10,672 16 6		£10,726 6 6
Coal carbonized—		Coal carbonized—	
2670 tons at 26s. 9d. (less value of tar) .	3,237 7 6	3201 tons at 26s. 9d. (less value of tar) .	3,881 4 3
Gross profit, 30·64d. per 1000 c.ft.	£7,435 9 0	Gross profit, 31·52d. per 1000 c.ft.	£6,845 2 3
		Gross profit, 1929 . .	7,435 8 4
		Advantage of 1929 over 1930 (in 28 days)	£590 6 1

In 1929 31·9 p.ct. of the gross cost of coal was recovered by sale of residuals to customers.
In 1929 19·1 p.ct. of the gross cost of coal was sold to C.W.G. plant.
In 1929 51·0 ,, ,, ,, ,, ,, ,, recovered.

In 1930 44·7 p.ct. of the gross cost of coal was recovered by sale of residuals to customers.
In 1930 7·1 p.ct. of the gross cost of coal was sold to C.W.G. plant.
In 1930 51·8 ,, ,, ,, ,, ,, ,, recovered.

Output of gas in 1929 = 21,810 c.ft. per ton of coal carbonized.
,, ,, 1930 = 16,277 c.ft. ,, ,, ,,

—	1929. Pence per 1000 C.Ft.	1930. Pence per 1000 C.Ft.
Net cost of coal as above figures. . .	10·03	10·91
Cost of coke in generator at 26s. 2d. per ton	2·33	1·18
Cost of coke in boiler for steam for C.W.G.	0·48	0·22
Cost of oil for C.W.G. (less value of tar)	2·55	0·80
	15·39	13·11

Cost of Coal "B."

1929	£ s. d.	Pence per 1000 C.Ft.	1930.	£ s. d.	Pence per 1000 C.Ft.
Coal carbonized—			Coal carbonized—		
2389 tons at 26s. 9d.	3195 5 9	14·71	3201 tons at 26s. 9d.	4281 6 9	19·72
Less tar recovered—			Less tar recovered—		
10 galls. per ton at 3d.	298 12 6		10 galls. per ton at 3d.	400 2 6	
	£2896 13 3			£3881 4 3	
Less coke sold to customers (4·59 cwt. per ton of coal)—			Less coke sold to customers (7·22 cwt. per ton of coal)—		
548 tons at 26s. 2d.	716 19 4		1156 tons at 26s. 2d.	1512 8 8	
Net cost of coal, 18s. 3d. per ton . .	£2179 13 11	10·03	Net cost of coal, 14s. 9·6d. per ton . .	£2368 15 7	10·91
Net cost = 68·1 p.ct. of gross cost			Net cost = 55·3 p.ct. of gross cost		

Revenue "B."

1929.	£ s. d.	1930.	£ s. d.
Gas sold—		Gas sold—	
225,298 therms at 10d.	9,387 8 4	225,298 therms at 10d.	9,387 8 4
Coke sold to customers—		Coke sold to customers—	
548 tons at 26s. 2d. .	716 19 4	1156 tons at 26s. 2d. .	1,512 8 8
	£10,104 7 8		£10,899 17 0
Less oil used—		Less oil used—	
35,094 galls. at 4¼d. (less value of the tar)	555 13 1	10,959 galls. at 4¼d. (less value of the tar)	173 10 6
	£9,548 14 7		£10,726 6 6
Coal carbonized—		Coal carbonized—	
2389 tons at 26s. 9d. (less value of tar) .	2,896 13 3	3201 tons at 26s. 9d. (less value of tar) .	3881 4 3
Gross profit, 30·64d. per 1000 c.ft.	£6,652 1 4	Gross profit, 31·52d. per 1000 c.ft.	6,845 2 3
		Gross profit, 1929 . .	6,652 1 4
		Advantage of 1930 over 1929 . . .	£193 0 11

ADVANTAGE OF 1930 OVER 1929.

In Statement B the percentage of the gross cost of coal recovered by the sale of residuals is the same as in Statement A, and the quantity of gas produced per ton of coal is, of course, also the same.

The market price of coke determines whether it is better to sell it in solid or gaseous form. It will be seen in Statement C that should the price fall to 15s. per ton, the advantage then reverts to the sale of a greater quantity of gaseous therms per ton of coal.

Cost of Coal "C."

1929.	£ s. d.	Pence per 1000 C.Ft.	1930.	£ s. d.	Pence per 1000 C.Ft.
Coal carbonized—			Coal carbonized—		
2389 tons at 26s. 9d.	3195 5 9	14·71	3201 tons at 26s. 9d.	4281 6 9	19·72
Less tar recovered—			Less tar recovered—		
10 galls. per ton at 3d.	298 12 6		10 galls. per ton at 3d.	400 2 6	
	£2896 13 3			£3881 4 3	
Less coke sold to customers (4·59 cwt. per ton)—			Less coke sold to customers (7·22 cwt. per ton)—		
548 tons at 15s.	411 0 0		1156 tons at 15s.	867 0 0	
Net cost of coal, 20s. 9·7d. per ton	£2485 13 3	11·44	Net cost of coal, 18s. 9·9d. per ton	£3014 4 3	13·88
Net cost = 77·7 p.ct. of gross cost			Net cost = 70·3 p.ct. of gross cost		

Revenue "C."

1929.	£ s. d.	1930.	£ s. d.
Gas sold—		Gas sold—	
225,298 therms at 10d.	9387 8 4	225,298 therms at 10d.	9387 8 4
Coke sold to customers—		Coke sold to customers—	
548 tons at 15s.	411 0 0	1156 tons at 15s.	867 0 0
	£9798 8 4		£10,254 8 4
Less oil used—		Less oil used—	
35,094 galls. at 4¼d. (less value of the tar)	555 13 1	10,959 galls. at 4¼d. (less value of the tar)	173 10 6
	£9242 15 3		£10,080 17 10
Coal carbonized—		Coal carbonized—	
2389 tons at 26s. 9d. (less value of tar)	2896 13 3	3201 tons at 26s. 9d. (less value of tar)	3881 4 3
Gross profit, 29·23d. per 1000 c.ft.	£6346 2 0	Gross profit, 28·55d. per 1000 c.ft.	£6199 13 7
		Gross profit, 1929.	6346 2 0
		Advantage of 1929 over 1930	£146 8 5

In 1929 22·3 p.ct. of the gross cost of coal would be recovered by the sale of residuals to customers.
In 1929 10·9 p.ct. of the gross cost of coal would be sold to C.W.G. plant.

In 1929 33·2 p.ct. of the gross cost of coal would be recovered.

In 1930 29·7 p.ct. of the gross cost of coal would be recovered by the sale of residuals to customers,
In 1930 4·0 p.ct. of the gross cost of coal would be sold to C.W.G. plant.

In 1930 33·7 p.ct. of the gross cost of coal would be recovered.

Costs per 1000 C Ft for Statement "C."

—	1929. Pence per 1000 C.Ft.	1930. Pence per 1000 C.Ft.
Net cost of coal as figures	11·44	13·88
Cost of coke in C.W.G. generator at 15s. per ton	1·34	0·67
Cost of coke in boiler for steam for C.W.G. at 15s. per ton	0·28	0·12
Cost of oil for C.W.G.	2·55	0·80
	15·61	15·47

In the hypothetical case shown in Statement C, the gross profit is £146 more in 1929 than in 1930, although only 22·3 p.ct. of the gross cost of coal is recovered by the sale of residuals to customers, as against 29·7 p.ct. in 1930. The cost of materials for manufacture in 1929 is 15·61d. per 1000 c.ft., as against 15·47d. per 1000 c.ft. in 1930; therefore it would appear that the cost of materials per 1000 c.ft. is not an infallible guide to economy.

So long as the market price of coke keeps above the economic level, it pays to dispose of it in the solid form, if possible. The local sale must be cultivated, and, in order that the coke may be in the best condition for domestic use, it must have as low as possible percentages of ash and moisture. These conditions are obtained by carbonizing coal in horizontal retorts, or unsteamed vertical retorts (steamed verticals must increase the percentage of ash), and using the C.W.G. plant with which as many gaseous therms as required can be made without detrimentally affecting the coke for domestic purposes.

If the sale of residuals from a ton of coal can realize an amount nearly equal to the purchase price of the coal, then it is not so important to obtain the maximum quantity of gaseous therms per ton; but, as the value of residuals falls further and further from the gross cost of coal, then the gaseous therms become of increasing importance, till a point will be reached where complete gasification will apparently be the solution of the problem.

A. L. BROADBERRY.

Hastings and St. Leonards Gas Company,
Glyne Gap Works, Bexhill,
March 7, 1930.

Dual Meter Reading (*ante* p. 638).

SIR,—It is strange how things recur. In the days of national service late in the war, and when everyone's time was precious, I was summoned to the headquarters at St. Ermin's Hotel. It was put to me by the official in charge (a wounded officer) if it were possible for one and the same man to take the gas and electricity indices. I said it would be possible, but that the after-work in dealing with these would cause more waste of time than leaving things alone. In the case I had in view it would concern two separate companies. The object was to get more men for the Army, but I think I convinced him.

C. W. B.

March 8, 1930.

On the Electrical Side.

Wet Hands Off Electric Radiators.

Judging from reports which come along at intervals, bathrooms do not appear to be the best of places into which to introduce electric radiators. At any rate, this applies to bathrooms used by people who are unaware of the risk of disaster in certain circumstances. This matter was commented on recently by the Blackpool Coroner, when inquiring into the death of a married woman. The husband said that his wife went for a bath on a Sunday afternoon. He afterwards heard a thud, and his wife was found hanging over the bath, with one hand resting on the electric radiator. Dr. Barnes said death was due to electric shock. There were burns on various parts of the body; and touching the radiator with a wet portion of the body intensified the effects of the current. It was a dangerous practice to have electric radiators in close proximity in a place where anybody could touch it with wet hands.

Electricity Requires Attention.

That knowledge and attention are necessary to the proper application of electricity in the home was demonstrated recently at Newcastle-upon-Tyne, when the members of a women's Electrical Association were given useful hints which included the following: A small piece of apparatus, such as a hair-drier, should not be put on to a heavy heating circuit first of all, for the fuse would blow if there should be a fault. Bulbs and fittings for lighting must be kept clean, or there may be anything up to 30 p.ct. loss in lighting efficiency. To get the greatest amount of use out of a radiator, it should not be stood in front of an open chimney, for the heat will be lost up the chimney. Those domestic appliances driven by motor must be kept well oiled. The dust bags of vacuum cleaners should be emptied frequently, or the air-piece of the cleaner will cease to pick-up the dirt as it should.

Wiping Out the Gas Industry?

Councillor P. J. Dollan, Convener of the Transport Committee of the Glasgow Corporation, would appear, according to a report which appeared recently in a local paper, to hold somewhat advanced views as to the use of electricity in the home. He took occasion to express these when proposing a toast at the annual dinner of the Scottish Division of the Electrical Power Engineers' Association. Prof. S. Parker Smith, of the Royal Technical College, Glasgow, had emphasized the neces-

sity for a greater use of electricity in the home, presumably in order that the current made available by the national grid scheme may be utilized. Then followed Councillor Dollan, who is put down as having said "that in Glasgow they had only wired 120,000 houses out of a possible 260,000, which illustrated what a big field there was in the city for expansion in the use of electricity. They had got to visualize the idea of wiping out the gas industry so far as its household use was concerned, because it was out of date as a domestic agency." The ratepayers of Glasgow, who possess in their great and efficient Corporation-owned gas undertaking an asset of extraordinary value, will possibly find it unpleasant to "visualize" anything of the sort; but we would urge them not to be downhearted. If they should succeed in "visualizing" the banishment of gas from the household, it will be no more than an "optical illusion."

The Old Example.

But, in the eyes of Councillor Dollan, it is not only in the home that gas is "out of date." He has been spending a week in Berlin and Leipzig. It is not clear whether his stay extended to a week in each city, or whether seven days divided between the two sufficed for the acquisition of all the knowledge with which he returned armed; but be this as it may, he has come back with the old, old story. Let us quote again from the paper: "After spending a week in Berlin and Leipzig, he had come back with the firm conviction that our shopkeepers, hotel owners, and restaurant proprietors had a great deal to learn from the Germans in the proper use of electricity. The streets of Berlin, because of the artistic and efficient use of electricity, were a delight to behold; whereas the main streets of Glasgow, for an exactly contrary reason, made people want to get away from them. It would pay the Association to combine with the Glasgow shopkeepers to send a deputation over there to see what could be done in the illumination of shops and streets." Why not arrange for the deputation to pass through London on their way out, so as to see some of the magnificent public lighting by gas, which is the envy of all who behold it? The deputation might then be able to "visualize" gas as being just where it is—in the very front rank, whether for the lighting of streets or for the rendering of efficient service in the home.

Where Does Gas Come In?

In a description of the work which is being done by the Shropshire, Worcestershire, and Staffordshire Electric Power Company in sparsely-populated portions of its area, it is learned that tests of soil-heating by the Company have definitely established that the application of current in March to resistance elements buried 9 in. below the surface and 2 ft. apart caused radishes, lettuces, peas, and beans to be advanced quite a fortnight in growth—an important consideration in the face of foreign competition in the provision of early vegetables.

Coal Prices and Electricity Charges.

By this time there is no excuse for misunderstanding as to the effect of increased coal prices upon the gas industry, and similarly there is now no room for doubt as to the influence which such a step will have upon electricity. In a letter to "The Times," Lieut.-Col. W. A. Vignoles (Director and Secretary of the British Electrical Development Association) has shown conclusively the mistaken character of a claim by a previous correspondent that, even if the price of coal was advanced by 40 p.ct., the effect on the cost of generation would be so small that it would not be necessary for supply undertakings to increase the price of electricity.

It is pointed out by Lieut.-Col. Vignoles that "in the financial year 1927-28 (the last for which the figures are available) the electricity supply industry used 8,000,000 tons of fuel, almost entirely coal; the average price being 18s. per ton. An increase of 40 p.ct. in the price of fuel would therefore cost the industry £2,880,000 per annum. This sum is larger than the total amount paid by electricity supply companies as dividends on their ordinary share capital. In the case of municipal undertakings, the rate of interest and redemption on the whole capital is fixed, so that in most instances the additional cost would have to be met either by an increase in the price of electricity or by a levy on the rates." The writer assumes that the correspondent to whom he replies had in mind the small number of lighting consumers who pay a substantial price per unit; but their proportion of the total distribution of current is trifling. "In 1927-28," the letter proceeds, "the average price for the whole of the electricity sold in Great Britain was only about 1½d. per unit (1·55d.), while 65 p.ct. of the total was sold for power purposes in industry, at less than 1d. per unit. Millions of units are being sold in industry at low prices with the smallest margin of profit."

The conclusion arrived at by Lieut.-Col. Vignoles is that in the majority of cases it would be necessary to pass on the additional cost to the consumer, and that where electricity is sold at a low price this increase may be substantial.

Topical Items.

Institution of Gas Engineers.

Arrangements for the Annual Meeting of the Institution in Leeds, from June 2 to 5, are well in hand; and the Secretary, Mr. J. R. W. Alexander, informs us that it will take place in the Town Hall, and will include an extraordinary general meeting of the old Institution. A meeting of the Council will be held in the Queen's Hotel at 5.15 p.m. on June 2.

Mr. Alexander has issued a diary of the meetings of the Institution, and the various Committees, for this year. The Autumn Meeting will be held in the Hall of the Incorporated Accountants, Victoria Embankment, on Oct. 8 and 9.

How Loyal Co-operation Results in Good Gas Service.

The very low price of Belfast's gas was mentioned at a social gathering of the gasworkers branch of the National Union of General and Municipal Employees. The Vice-Chairman of the Gas Committee (Councillor Albert Hodgen, J.P.), one of the guests, said this cheap price was due not only to good management, but to the loyal co-operation of the workers. [Applause.]

The Chairman said the Department provided steady employment for over 1000 men, and paid an annual sum of £150,000 in wages, apart from the remuneration paid to salaried officers. Despite the increased competition from other forms of fuel in recent years, the Undertaking continued to make steady progress, and the fact that the output of gas continued to increase year by year was a sure indication that the convenience, economy, and reliability of gas for lighting, heating, and cooking were fully appreciated by the citizens of Belfast. [Applause.]

In the regretted absence through indisposition of Mr. J. D. Smith, the General Manager of the Gas Department, Mr. J. Hyslop (Superintendent) responded to the toast of the Senior Officers of the Gas Department.

Wellington Gas Company Staff Dinner.

Deeds and other legal documents relating to property owned by the Wellington Gas Company were presented to the Directors by Mr. R. D. Newill (Clerk to Wellington Magistrates and Secretary to the Company) at the Annual Dinner to employees on Saturday, March 1, when Mr. R. J. Milbourne, J.P. (Vice-Chairman of Directors), presided. The documents date back to 1750.

Mr. Newill's father was a member of the legal profession, Clerk to the local Magistrates, and Secretary to the Gas Company. Mr. Newill succeeded his father in both positions. Many old servants of the Company wore their long-service decorations. Two had been employed for over 40 years, and seven for more than 30 years.

The Chairman accepted the old documents on behalf of the Directors, and remarked that it was very gratifying in these days to receive something for nothing from a lawyer. [Laughter.]

After dinner Mr. H. J. Woodfine (Company Manager) submitted the toast of "The Wellington Gas Company and Board of Directors." He reviewed the work of the Company during the 25 years he had been connected with it. They had an excellent Board of Directors, and the loyalty of the staff had enabled them to make progress beneficial to the town and district.

The Chairman, seconding, said all regretted the absence of the Chairman of Directors, Mr. C. W. Leake, who had laboured for so many years on behalf of the Company and had displayed commendable enterprise. They had up-to-date and well-equipped works, and in recent years their business had extended, this being largely due to the skill and loyalty of the staff. He had no fear of competition from their friends in the electricity undertakings so long as they continued to render efficient service to the community. They occupied a proud position among 60 of the leading gas companies of the country.

Mr. J. Stock (Works Manager) and Mr. Cooke also spoke, and Mr. W. M. Burchell (official gas tester for the district), Mr. W. Atkinson (St. George's), and Mr. Rumble (Reading Gas Company) responded to the toast of "The Visitors."

Northern Star Lodge, No. 3053.

Installation Meeting

The Installation Meeting of the Northern Star Lodge, No. 3053, was held on Friday, Feb. 28, when the new W.M. was duly installed, and appointed his officers.

The following is a complete list of the officers of the Lodge for 1930-31:

W.M.	W.Bro. R. B. Glover (Bramhall).
I.P.M.	W.Bro. Alexander Mackay (Stoke-on-Trent).
S.W.	W.Bro. W. J. Smith (Bolton).
J.W.	Bro. James Mitchell (Nelson).
Chaplain	W.Bro. L. B. Taylor, P.Pr.G.D. Staffs. (Dudley).
Treasurer	W.Bro. Harry Butterworth (Blackley).
Secretary	W.Bro. Maurice L. Williams (Lymm).
D.C.	W.Bro. James Bridge (Elland).
S.D.	W.Bro. G. Mitchell (Blackburn).
J.D.	Bro. John T. Haynes (Bolton).
A.D.C.	W.Bro. C. Ernest Teasdale (Manchester).
Almoner	W.Bro. Ernest West (Manchester).
Organist	W.Bro. E. J. Wellens (Wombwell).
I.G.	Bro. R. W. Broadhead (Manchester).

The Pros and Cons of a Gas Grid.

In a letter to the "Manchester Guardian" for Wednesday last, Mr. Alan E. L. Chorlton, of London, a Consulting Engineer, wrote as follows:

> Despite the increased facilities and reduction in price of current arising out of the great national system of electric supply with interconnected power-generating stations, generally known as the grid, the development in the use of gas proceeds apace, as the returns from companies and municipalities lately made public in the Press so amply demonstrate. All this seems to me to call for the entire exploitation of a scheme for gas similar to that for electricity, the linking-up of the existing stations, the establishment of super-production stations of the highest efficiency, where the distillation of oil would be one of the objects to replace some of the large amount at present imported, together with long-distance gas supply. Not only is this a matter of national economy, of increased facility to trade, but it would provide for much employment in the carrying-out of the scheme.
>
> It is fairly well known that a project of this nature is already in active work in the Ruhr district of Germany, and so well and to such distance is gas supplied that a pipe is now to be carried to Cologne through the River Rhine itself. Long-distance supply gas from Amarillo to Denver, 375 miles, is a successful instance in the United States, a greater distance than from any coalfield to any large city in this country.

The problem was further discussed in the columns of the "Manchester Guardian" last Thursday.

Among the criticisms advanced to a "Manchester Guardian" reporter against Mr. Chorlton's suggestions, the first was that the conditions in this country are not comparable with those in Germany and America; and the second, that neither are the problems raised by the manufacture and distribution of gas and electricity comparable.

In regard to the American example of the transport of gas 375 miles, it was commented that in this instance and any at all similar the gas is invariably a natural and not a manufactured product which, if not taken long distances, would be wasted. In Germany, it was said, gas had certainly transported over long distances, but in the process the heavier hydrocarbon constituents tended to be separated, with consequent pipe-stoppage troubles. Measures to overcome these were at present having to be devised.

One local authority observed that Mr. Chorlton appeared to make certain fundamental errors. The first was that, in comparing the economic efficiency of the large gas-works with that of the large electricity works, he overlooked the elementary fact that electricity could not be stored, and that therefore the dynamo must be able to supply the required load at its maximum. Gas could be stored and "evened out" over the day's needs without raising the same peak-load problem.

The second oversight was that the high efficiency of the electricity super-station depended on the size of the plant. It was the 50,000 kilowatt-hour dynamo that had the highest efficiency. But in the production of gas the small plant was often as efficient as the large one, and might even be more efficient and its product cheaper. A large gas-making plant was but a multiplication of such small units, except that there was, in fact, a slight tendency for a gas plant to diminish in efficiency when increased unduly in size, because of the loss of the engineer's "personal touch." That possibility did not arise in the case of high-power dynamos.

Another critic urged the technical difficulties of maintaining the requisite pressure and temperature in long-distance transmission and the problem of transporting the residuals—especially the coke—from super-stations to areas sufficiently populous to consume them.

Yorkshire Juniors Visit Huddersfield Gas-Works.

A Meeting of the Yorkshire Junior Gas Association took place on Feb. 22 at the Huddersfield Corporation Gas-Works. About eighty members of the Association were present, and were welcomed by Mr. T. Dyson, in the unavoidable absence of Mr. H. Singleton (Engineer and Manager). The afternoon was devoted to a tour of inspection of the extensive works, under the guidance of Mr. Dyson and other members of the staff.

Afterwards an ordinary business meeting was held in the works canteen, under the Chairmanship of Mr. F. FIRTH, Chief Chemist to the Leeds Corporation Gas Department, and President of the Association.

Mr. B. THORPE, Chief Chemist to the Huddersfield Corporation Gas Department, read a paper on "Gas Lighting." This, and the ensuing discussion, will be found on later pages of this issue.

Pharmaceutical Students at Gas Department's Chemical Works.

A large party of pharmaceutical students from the local Municipal College of Technology spent a very interesting afternoon in being conducted over the Chemical Department of the Belfast Corporation Gas-Works. Mr. Hugh H. Orr, M.I.Chem.E. (Manager of the Department), had charge of one group, and they were accompanied by Mr. Fred Storey, President of the Pharmaceutical Society of Northern Ireland (who had arranged the visit), and Prof. Wren and Mr. I. W. Porter, F.I.C. Another group was conducted by Mr. P. M'Allister, and accompanied by Mr. C. I. Still and Mr. C. W. Young, B.Sc.

At the conclusion, Mr. F. Storey, in moving a vote of thanks to the Committee, Mr. J. D. Smith (General Manager of the Gas Department), Mr. Orr, and Mr. M'Allister, said they were greatly indebted to Mr. Orr for the trouble he had taken.

Prof. Wren, in seconding, said it was his first visit to the gas-works, and it was most interesting and instructive. The students were able to see the process of manufacture on a large scale, as distinct from laboratory practice and routine.

Mr. Orr, in thanking them, said it was a pleasure to explain to them the various processes.

Effect of Mechanical Equipment in Belfast Gas Offices.

Following the introduction of billing and posting machines in the Belfast Gas Office, the Gas Department, in the City Hall, has been totally reorganized. The General Manager, Mr. J. D. Smith, reports that the system has been a complete success. In illustration he cites that in 1920 the accounts of 51,562 consumers were handled by 24 clerks, whereas to-day 60,224 accounts are handled by 17 clerks. Under the old system the number of clerks would have been increased to 28, so that they were saving the salaries of 11 clerks at a maximum of £300 per annum—not to mention two extra collectors. The title of the Complaints Staff has been altered to Gas Consumers' Service Department.

The Manager's report also contained the following interesting paragraph: The maximum economies to be derived from the introduction of machines for clerical work can be obtained only by the gradual substitution of female operators for the present staff of male clerks. Apart from the fact that machine work is not worth the high salary which these men are now paid, their "hefty" manipulation tends to shorten the life of a Burroughs' machine and to necessitate frequent repairs. I recommend that I be authorized to appoint lady clerks to fill the vacancies caused by the retirement, transfer, or promotion of men engaged on machine work. These lady clerks should start at a wage of £2 per week, rising by annual increments of 5s. to a maximum of £3 per week. The persons to be appointed must submit certificate of educational qualifications not less than the Higher Grade Certificate, together with medical certificate of good health, and if possible to have practical experience of operating Burroughs' machines.

Water Storage Heaters at Ideal Home Exhibition.—The difficulty of demonstrating water storage heaters at the Ideal Home Exhibition will be overcome this year by Radiation Ltd., at whose stand overhead water tanks will be fitted. The public will thus have an opportunity of testing the efficiency and economy of John Wright's "Sunhot" and Richmonds "Equator," which will be connected to baths on the stand. Radiation Ltd. are also arranging for frequent demonstrations on a "New World" cooker in which a complete dinner of several courses will be cooked simultaneously at one setting of the "Regulo" dial.

Commercial and Industrial.

Stock Market Report.

[For Stock and Share List, see later page.]

With the reduction of the Bank Rate from 4½ to 4 p.ct. on Thursday last, and the consequent low bank deposit rate, business on the Stock Exchange was much brighter towards the close of the week. The Gas Market, however, remains dull, and there is little of interest to report. There were only three small increases in value—viz., Cambridge 5 p.ct. debenture 2 points to 91½; Croydon maximum dividend 1 to 68½; and Gas Light 3½ p.ct. maximum ¼ to 61½. On the other hand, apart from *ex* div., reductions, Imperial Continental dropped 10 points to 360, and Liverpool 5 p.ct. ¼ to 89 on the Liverpool Exchange. A purchase of the latter stock is well worth consideration. The Company has distributed 6 p.ct. for the past two years, and, at this rate of dividend, the yield at the current price is nearly 6¾ p.ct. Moreover, as the stock changed hands last year at as high as 95½, it is clearly undervalued at the present time, and some improvement should take place in the near future. The Wandsworth Company's 5 p.ct. debenture stock is also attractive, yielding, at the current price of 92½, £5 8s. p.ct.

Coal Markets.

Weakness continued throughout the markets last week, though towards the end of the period there was a slightly better feeling in some sections, notably in Durham coking coals. But even here the price was little better than 14s. 3d. for good qualities, compared with 16s. not so many weeks ago. Very little prompt business is circulating for gas coals. Wear Specials are still called nominally 17s. f.o.b., and bests of the Holmside, Boldon, class 16s. 3d., but these prices can probably be discounted. Seconds are quoted from 14s. to 14s. 6d. Tenders are now in for contracts for several Scandinavian and Danish gas-works, results of which are expected to be disclosed this week.

Yorkshire trading is very quiet, and prices easy. As an indication, the official approximate prices for export show a decline at 17s. 3d. to 17s. 6d. for screened gas, 16s. 6d. to 17s. washed trebles, 15s. 9d. to 16s. washed doubles, and 14s. 3d. washed singles.

There is little movement in gas coke, and the demand is quiet. About 22s. seems an average value.

Trade Notes.

Spiral-Guided Holder for Sowerby Bridge.

The Sowerby Bridge Urban District Council, on March 6, accepted a tender by Messrs. Robert Dempster & Sons, Ltd., of Elland, to erect a new spiral gasholder.

Belfast Purchases Whiteabbey Gas Supply.

The Belfast Corporation, through its Gas Manager (Mr. J. D. Smith), has agreed to purchase, at £3500, the gas mains, services, lamps, meters, fittings, &c., in the Whiteabbey district from the Whiteabbey Flax Spinning Company.

London Office for Messrs. Lotz & Kier.

We are informed by Messrs. Lotz & Kier, Civil Engineers and Contractors (reinforced concrete), that they have opened a London Office at 36, Victoria Street, S.W. 1, and have appointed Mr. R. V. Chate, A.M.Inst.C.E., as their Manager there.

New Bradford Holder Sanctioned.

The Bradford Corporation Gas Committee have received Ministry of Health sanction for a new holder at the Valley Road Works in connection with the water gas plant to be installed. The tender of Messrs. Robert Dempster & Sons, Ltd., of Elland, has been accepted to provide the holder.

Air Compressors.

The Hamworthy Engineering Company, Ltd., of Poole, have published a new list (No. 824) of starting compressor sets which are used for supplying compressed air to start large internal combustion engines, as well as for other purposes. These compressors will supply air at any pressure up to 1000 lbs. per sq. in.

Tully Complete Gasification Plant for Inverurie.

The Inverurie Gas Company have placed a repeat order with Messrs. Tully, Sons, & Co., Ltd., for a 150,000 c.ft. per day "Tully" complete gasification plant of the most modern type, complete with patent mechanical operator and waste-heat boiler. The existing plant, which has been at work for the past ten years, is to be overhauled and used as a standby for the new plant, which will produce the whole of the gas for the town.

A New Broadhead Brochure.

Messrs. Broadhead Constructions, Ltd., of Stretford, Manchester, have recently published a new brochure which they are distributing to gas engineers throughout the British Isles. In it they have briefly set out, to the accompaniment of an attractive series of photographs, the scope of their activities, and have given some details of contracts which have been carried out by the firm in various parts of the kingdom. Their activities embrace almost all gas-works constructional work, and this new brochure makes very interesting reading.

Current Sales of Gas Products.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *March* 10.

The prices of tar products remain unaltered.

Creosote for export is 6¼d. to 6½d. per gallon f.o.b.

Pitch is 47s. 6d. per ton f.o.b.

Pure toluole is 2s. 5d. to 2s. 6d. per gallon; solvent naphtha, 95/160, about 1s. 5d. per gallon; pure benzole, about 1s. 11d.; and pyridine bases, 3s. 9d. per gallon.

Tar Products in the Provinces.

March 10.

The average prices of gas-works products during the week were: Gas-works tar, 21s. 6d. to 26s. 6d. Pitch—East Coast, 46s. f.o.b. West Coast (f.a.s.)—Manchester, 40s. 6d. to 41s.; Liverpool, 44s. to 45s.; Clyde, 44s. to 45s. Toluole, naked, North, 1s. 7¼d. to 1s. 8¼d. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 3d. to 1s. 3¼d. Heavy naphtha, North, 1s. to 1s. 0¼d. Creosote, in bulk, North, liquid and salty, 3¼d. to 3⅜d.; low-gravity, 1¼d. to 1½d.; Scotland, 3¼d. to 3⅜d. Heavy oils, in bulk, North, 5¼d. to 6d. Carbolic acid, 60's, 2s. 4d. to 2s. 5d. prompt. Naphthalene, £12 to £14. Salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Tar Products in Scotland.

GLASGOW, *March* 8.

Orders continue scarce, and any alteration in values during the week is infinitesimal. There have been several export inquiries for pitch on the market; but the orders are not likely to come to Scotland.

Pitch.—There have been more inquiries, but prices are unaltered at about 47s. 6d. to 50s. per ton f.a.s. Glasgow. Home trade is quiet at about 2s. 6d. per ton premium on export price.

Tar quotations remain firm at 4d. to 4½d. per gallon *ex* works in buyers' packages.

Creosote.—Very little is being used for timber preserving at the present time, and stocks of B.E.S.A. specification oil are increasing. B.E.S.A. specification is 3⅜d. to 4¼d. per gallon; low gravity, 3d. to 3¼d. per gallon; neutral oil, 3d. to 3¼d. per gallon—all in bulk quantities f.o.r. works.

Cresylic.—Spot lots are scarce, but values are unaltered. Pale 97/99 p.ct. is 1s. 8⅜d. to 1s. 9⅜d. per galon; dark 97/99 p.ct., 1s. 7¼d. to 1s. 8¼d. per gallon; pale 99/100 p.ct., 1s. 11¼d. to 2s. 0¼d. per gallon; high boiling, 1s. 10d. to 1s. 11d. per gallon—all free on rails works.

Crude Naphtha.—The price is nominal at 5¼d. to 6d. per gallon *ex* works.

Solvent Naphtha.—90/160 grade is steady at 1s. 2¼d. to 1s. 3¼d. per gallon, but 90/190 grade is easier at 1s. to 1s. 1d. per gallon.

Motor Benzole.—Some business has been done at 1s. 6d. to 1s. 6¼d. per gallon f.o.r. works in bulk.

Pyridines are without interest at 4s. 3d. to 4s. 6d. for 90/140, 3s. 3d. to 3s. 6d. for 90/160, 2s. 6d. to 2s. 9d. for 90/180, while 90/220 remains unsaleable.

Benzole Prices.

The following are considered to be the market prices at the present time:

	s. d.	s. d.	
Crude benzole	0 10 to	0 11	per gallon at works
Motor "	1 5½ "	1 6½	" " "
Pure "	1 10 "	1 11	" " "

Contracts Open.

Carbonizing Plant.

The Coleraine Borough Council invite tenders for the supply, delivery, and erection of an installation of continuous vertical retorts, with coal handling machinery. [See advert. on p. 720.]

Coal.

The Gas Committee of the Borough of Leigh, Lancs., invite tenders for the supply of gas nuts and slack. [See advert. on p. 720.]

Gasholder.

The Coleraine Borough Council invite tenders for a spiral-guided gasholder to be built in an existing tank. [See advert. on p. 720.]

Purifiers.

Tenders are invited by the Ashford Urban District Council Gas Department for the supply and erection of two purifiers. [See advert. on p. 720.]

Assay of Coal for Carbonizing Purposes.*

There is surely nothing for which the soul of the carbonizing engineer yearns more than a laboratory method which shall give him a fairly accurate indication of the yield of gas and residuals to be expected in practice, and it is apparent from this paper that the staff of the Fuel Research Station has succeeded in coming very near to the accomplishment of so desirable an object, at any rate as regards carbonization in horizontal retorts. The modification of the well-known Gray-King low-temperature assay apparatus to obtain these results is interesting. It consists "only of the provision of a longer tube" to accommodate a zone of high temperature, the extra length being filled-in with crushed silica brick heated by an additional small furnace to the desired temperature, reproducing the cracking (and presumably the degradation) which goes on in a horizontal retort as the gases pass away over the heated upper portion of the retort.

The correlation of results with those obtained in horizontal retorts is remarkably close, the factor being approximately unity as regards gas volume and thermal yield. The correlation with continuous vertical retort practice, at any rate the practice of the Fuel Research Station, seems to be a long way out. Examining the tables at the end of the paper, we could see no consistency in the results at all. We are inclined to think that they are all vitiated by the wholly artificial conditions under which the tests are conducted. We are sure that the practice of maintaining a constant throughput under all conditions of steaming and the same carbonizing temperature for all sizes and kinds of coal bears no relation whatever to retort house practice, in which the whole object is to obtain the maximum thermal production per retort when making gas of the desired calorific value with the coal available. In other words, the constant is the calorific value; throughput and combustion chamber temperatures are regulated solely by the necessity to obtain the best value from the coal and from the retort.

We should very much like to see a series of tests carried out with progressively reduced calorific values on these lines; and we think it would be found that, instead of the simple arithmetical proportion here aimed at, we should be able to see a connection between the results obtained in the high-temperature assay apparatus and the "straight gas" results, and that the results with steaming would follow down the curves which are used by the makers of the continuous vertical retorts. If some such rational correlation as this should be found to exist, it would be distinctly interesting and useful.

As it is, we find it difficult to account for the great differences in yields from such similar coals as (say) Ravine and Arley, Wearmouth and Holmside. We assume there must have been other variables than those given in the tables, such for instance as wide differences in carbonizing temperatures, speeds of throughput affecting the time of contact with steam and heat, variables the effects of which are very soon reflected in the results.

We protest against two practices in this paper. First that of omitting the calorific value of the gas made. This quantity is, of course, the primary measurement from which the quantity "therms per ton" is derived. Of course it can be calculated, but why should it not be given? Then we object to reducing results to "dry ash-free coal." A carbonizer gets into his memory certain rough figures giving him what is to be expected from the usual run of gas-making coals with the usual ash and moisture contents. These figures correspond to realities. When they are reduced to the hypothetical conditions of no ash or moisture, they correspond to nothing in the world. Nor do we see that they assist comparisons in any way. If they did we should see the effects in such a table as No. 7.

In order to see where we were, we plotted these figures on a set of "West's steaming curves" as used by Mr. J. Poulson, of Oldbury, in a paper he read before the Midland Association of Gas Engineers in March, 1928—see "GAS JOURNAL," Vol. 182, p. 55; also Alwyne Meade, 2nd edition, p. 426. We found that, as the size of the coal was decreased from large to medium and to small for Mitchell Main using 10 p.ct. steaming, we got a progressively better result, the figures came roughly on curves C, E, and F respectively. Of course, we had to add curves E and F to Mr. Poulson's chart. Dalton Main improved from B to D† and to E†, but Shafton large coal result appeared right down on curve 4, while both the "medium" and the "small" results fell on curve C. As we were given no data with regard to the ash and moisture contents of the different sizes of the several coals, we could not correct the figures to actual working conditions; but we are looking forward to the publication in full of these interesting and valuable tests.

With regard to Table 8, we find that the results fall on lower curves than those of the Assay Table 2; and in the absence of data as to temperatures, &c., we could form no idea of the possible reasons.

The discrepancies between assay and working results as regards tar and ammonia, even in the case of horizontal retorts, are presumably explained by the difficulty experienced in collecting these bye-products in small-scale plant, particularly tar. The correlation factors for coke are in all cases much nearer unity, and, therefore, we should think, much more reliable.

It is obvious that the "steaming" process in continuous vertical retorts is not one of degradation of the products of distillation, but an addition of water gas to the comparatively slightly modified products of the straight distillation of coal. So that, as far as vertical retorts are concerned, the evidence shows that the work is to be regarded only as one of those valuable pieces of research work yielding negative results but indicating that further work along these lines is valueless (*i.e.*, attempts at correlating results obtained by "cracking" of the volatile products with results obtained by "steaming" in continuous vertical retorts).

The checking of the subject-matter and the reading of proofs does not appear to have been carried out here as scrupulously as we have come to expect from these publications. A glaring example is the analysis of the vertical retort gas on p. 17, which adds up to 110 p.ct. We suspect that the 20·6 p.ct. of CO is a rather high figure for 5 p.ct. steaming.

The paper is an extremely interesting addition to the publications of the Fuel Research Board.

"T.A.M.B.T."

* "The Assay of Coal for Carbonizing Purposes (Part III.) Correlation with Coal Gas Manufacture." Fuel Research Board (Technical Paper No. 24); J. L. King & L. J. Edgcombe. Department of Scientific and Industrial Research; pp. VI. + 30, price 9d. Published by H.M. Stationery Office, Adastral House, Kingsway, W.C. 2.

Sir Arthur Duckham's Views on Co-Partnership.

On Thursday last Sir Arthur Duckham, G.B.E., K.C.B., addressed the members of the Industrial Co-Partnership Association, the occasion being a luncheon at the Holborn Restaurant—Viscount ASTOR presiding.

Sir ARTHUR DUCKHAM said: To me the necessity for co-partnership in industry is as axiomatic as the statement that a straight line is the shortest distance between two points. It is interesting to look back on the growth of industry and to realize the development of the position of the manual worker. A hundred years ago the attitude of the employer towards his employee was that as much as possible had to be got out of him at the minimum of cost. No attention was given to the welfare of the employee, no consideration was given to his aspirations, and he was not encouraged to have any. Health, accident, and other services were non-existent, and would have been considered absolutely unwarrantable and impossible if they had been suggested.

This pressure on the worker resulted in a combination of workers, and the forcing through by them of certain measures to ameliorate their lot. In certain cases, more enlightened employers realized that a happier and more contented worker gave better service and was a better business proposition, but in the majority of cases the worker was treated with even less respect than a machine, and was considered of less importance than a machine, as he could be discarded without loss of capital value.

The Trade Union movement won its way through against great opposition, and in that movement existed—and still exists—the antagonistic feeling bred by the old selfish attitude of the employer. In consequence, as the Trade Unions became powerful, so the two camps have been built up, and antagonism in industry has developed.

In attending meetings which represent employers, one hears criticisms of high wages under Trade Union conditions. In attending meefings representing the manual worker, one hears of the wickedness of capitalism. It is not the amount of wages paid that matters; it is the services obtained for those wages. In possibly the majority of cases the paucity of services obtained is due to maladministration in the industry or the individual concern. In all industries and in all countries, however depressed they may be, it is possible to find a number of concerns that, despite adverse conditions, are sufficiently prosperous. In each case you will find that the management is alive, that it is sympathetic to the aspirations of the workers and knows how to get the best out of them, that it is up to date in its practice and efficient as to the distribution of its products.

The employer, when business is bad, is too often prone to say that wages are too high. Wages are the easiest line of

attack. If, instead of this, the employer thoroughly investigated his own business and assured himself and his workmen that their services were being used in the most efficient manner, complaints of bad business would be fewer.

The second reason for lack of service for wages paid is Trade Union regulations. Undoubtedly some of these regulations are based on uneconomic surmises, but I have found that by personal contact between the employer and the Trade Union, in practically every case some satisfactory means of working can be arrived at. The greatest curse to such negotiations is usually the lack of confidence, in the first place between the members on either side of the conference, and the lack of confidence between the two sides as a whole. We have suffered in the past from selfishness on both sides, and through fear of putting the actual facts forward.

My experience is that, if negotiations and dealings are on a perfectly honest, straightforward basis, then the Trade Unions are the most helpful organizations towards prosperity in industry.

The third reason for sufficient service not being obtained for wages is the uneconomic teaching that the worker is being used for the profit of the employer and the capitalist, and therefore should give the minimum of service for the maximum of wage, and that the power of the Trade Unions should be used to maintain such a situation.

Fundamentally, the worker produces wealth, but only under proper direction and supported by a sufficiency of capital. The worker, by withholding his proper labour, is working against prosperity in industry, and therefore against his own interests.

We hear criticism of the capital system and of the capitalist. To my idea, capital should be divided into two sections—capital that is directly utilized in industry and the adjuncts of industry, and capital that is used for endeavouring to obtain further wealth without direct productive effort. The capitalist system as directly applied to industry is to me but a system of accountancy. Some method has to be adopted to estimate and compensate for the values of raw material and of service both as between those engaged in production and as between the producer and the consumer.

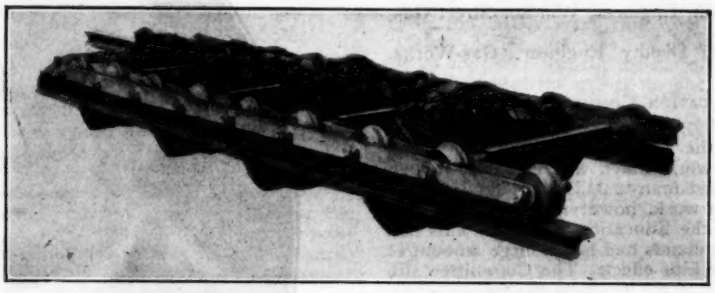
We must have the closest co-operation between all those concerned in industry. Co-partnership shows the way, but co-partnership must be accompanied by some form of profit-sharing. The worker must be made to feel that he is not an isolated unit of a business, but that the business is as important to him as to the highest administrator or to the largest shareholder. The administrator, on the other hand, must put himself in the place of the worker, realize his aspirations, and endeavour to fulfil them, and so make him contented.

In industry, too much is secret. The workers in the first case are not taken into the confidence of the director, and responsibility is not passed down the line until each worker feels that he is responsible for his job. It must be shown that all in industry benefit.

The gas industry is an example to all industries in this country, in that, for over a generation, there has been no major trouble in the industry. Co-partnership and profit sharing are general. There is a different feeling among all gas employees in whatever sphere they may serve, than among employees in any other industry in this country.

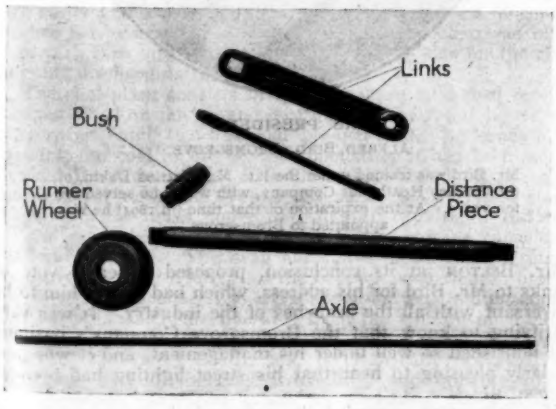
In conclusion, I would turn to the coal industry, which has been penalized by labour unrest for many years, and in which co-partnership should exist. One of my criticisms of the present Coal Bill is that no mention is made of the participation of the workers in any sphere of the working of the pit other than the actual manual work. I believe that, if co-partnership in its true sense was prevalent in the coal industry, not only would labour disturbances be cut out, but also that the prosperity of the pits would be increased, and an industry which is the basis of our industrial life would be brought back to a truly flourishing position.

Lip-Bucket Conveyor Improvements.



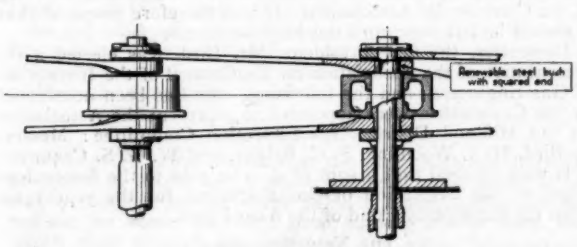
THE WEST LIP-BUCKET CONVEYOR.

The durability of West elevators and conveyors has depended on the renewable bush chain more than on anything else. It is a design which was adopted over forty years ago, and which, so long as coal was the material usually handled, produced a chain with practically unlimited life. The handling of coke is a different matter. The introduction of the West lip-bucket conveyor has made demands on the chain which have only been successfully met by improvement in the details of the design and in the materials and methods used in its manufacture.



The Component Parts of the Improved West Lip-Bucket Conveyor Chain.

The links of the chain are steel drop-forged to a section of constant strength, but the material now used is increased from the ordinary 28 to 30 ton steel to the 40-ton mild steel—that is to say, steel with a tensile strength of 40 tons per sq. in. The advantages of such a material prepared in such a manner are obvious. It is absolutely homogeneous and reliable in every piece. There are no blow-holes and there are no fibrous cores, as may be found in the best castings and in the best rolled bars. The drop forging increases the density and the toughness of the material. Breakages of links are practically unknown, even when the conveyors have been subjected to considerable ill-usage.



The Renewable-Bush Chain.

The great point, of course, in the design of the renewable bush chain is the articulation or joint which is constructed in two parts. The inner pair of links is held tightly together by means of the bush, through which outer pair of links runs a steel pin fixed relative to the outer pair of links and turning, at changes of direction only, within the bush. The wearing surface of the joint of the chain extends over the full length of the bush, which is itself prevented from movement relative

to the links. There is no wearing action whatever between the links and the joint pin.

The recent improvements mainly relate to the bush. This portion of the chain used to be made of cast malleable iron, cast steel, or semi-steel, and it is used to be fixed relative to the link by means of a V-shaped end, which was hand fitted to the link. Obviously such a construction could be brought more into line with the principles of modern machine design. The bush as now made is turned in an automatic machine from high-grade bar steel to fine limits, and then the wearing surface or journal for the runner wheel is heat-treated to give a suitable degree of hardness. The end of the bush is squared to prevent relative moment between it and the stamped steel link. Every joint of the chain is supported in an internal oil-filled chambered running wheel of large diameter.

The advantages of the combination of the original principles and the recent improvements in the design may be stated as follows:

(1) The lubrication of the running wheels is internal.
(2) The journal is not exposed to the action of coke dust.
(3) The hardened surface of the journal (on the bush) makes for long life.
(4) The wearing surface is proportionately very large.
(5) The bush is readily renewed; it is an automatic-machine-made job; its cost is low compared with that of the side links.
(6) The stamped links are relieved of all wear and tear, and practically never require renewal.

The interesting feature of the improvements is that they can be adopted in any existing chain by inserting a length of the new chain, which joins up without any trouble, though, naturally, the new bushes cannot be fitted to the old links. Several renewals made in this way have proved satisfactory, and evidence is already forthcoming that the recent improvements have succeeded in very materially increasing the life of the West lip-bucket conveyor under the most severe conditions of handling coal and coke at one and the same time.

"W. G." in "West's Gas."

Midland Association of Gas Engineers and Managers.

The Annual General Meeting of the Association was held on Thursday of last week, in the Grand Hotel, Birmingham; the chair at the outset of the proceedings being occupied by Mr. C. M. D. BELTON, of Shrewsbury, the outgoing President, who subsequently gave place to the new President, Mr. ALFRED BIRD, of the Bromsgrove Gas Company.

The HON. SECRETARY (Mr. Arthur Roberts, of Hereford) read the minutes of the last meeting, which were confirmed; and he intimated the receipt of a number of apologies for absence, which included one from Mr. James Paterson, of Cheltenham, who had, he said, been very ill, and was at the moment recuperating at Torquay.

The following were, on a ballot, unanimously elected members of the Association:

Mr. George Charles Pearson, Engineer, Windsor Street Gas-Works, Birmingham.
Mr. Leslie Pool Ingram, Deputy Engineer, Gas-Works, Dudley.

DISTRICT EDUCATION COMMITTEE.

Mr. F. C. BRIGGS (Dudley), on being called upon by the President, said he thought the Midland Gas Education Committee had continued to do work which was valuable, though unostentatious. They had had many applications for information. The larger part of the work, however, had been in connection with the revision of the Education Scheme. This had now been revised, and the Midlands had had a large amount of work to do in carrying that into effect. The Committee still existed; but the greater part of the work in the future would be in endeavouring to form new centres and classes to satisfy the students. He would like to take this opportunity of appealing to engineers to encourage their juniors to take classes, and to let the Committee know if there was any shortage of such classes. It was very desirable that students should get their instruction in a technical institute.

Mr. BELTON remarked that he knew of many instances in which the Committee had been of considerable assistance.

The annual report and statement of accounts were next put to the meeting and adopted.

With regard to the report of the Midland Commercial Gas Association, it was pointed out that this could not be taken at the moment, as it had not yet been before the annual meeting of the Commercial Association. It was therefore proposed that it should be left over until the May meeting.

Thereafter, the new President, Mr. Bird, was elected a representative of the Association on the Council of the Institution of Gas Engineers; and the following, who had been nominated by the Committee, were appointed to represent the Association on the Midland District Gas Education Committee: Messrs. A. Bird, H. J. Woodfine, F. C. Briggs, and W. G. S. Cranmer.

It was resolved that a sum of £10 be paid to the Benevolent Fund of the Institution of Gas Engineers for the year 1929, from the Emergency Fund of the Association.

THE NEW PRESIDENT.

Mr. BELTON said he had now the very pleasant duty to perform of inducting the new President, Mr. Bird. He was sure that the office would be admirably filled by him.

Mr. A. BIRD (Bromsgrove) then took the chair, and proposed a vote of thanks to Mr. Belton for his services as President during the past year. Mr. Belton, he said, had conducted the business with efficiency and dignity. His name was an honoured one in connection with the Association. On every possible occasion he had done all he could for the Association and for the industry at large. It was a pleasure, therefore, to present him with the medal of the Association, as a souvenir of his Presidency.

Mr. W. S. MORLAND (Gloucester) seconded the vote, with the remark that Mr. Belton was invariably anxious to help in every possible direction.

Mr. H. J. WOODFINE (Wellington) endorsed what had been said, and added that Mr. Belton left the Association the stronger for his occupancy of the chair.

Mr. BIRD then delivered his address, which is reproduced in another part of this issue.

THE PRESIDENT,
ALFRED BIRD, BROMSGROVE.

Mr. Bird was trained under the late Mr. Charles Dakin, of the Cradley Heath Gas Company, with whom he served for ten years. At the expiration of that time (in 1894) he was appointed to Bromsgrove.

Mr. BELTON, at its conclusion, proposed a hearty vote of thanks to Mr. Bird for his address, which had shown him to be conversant with all the branches of the industry. It was very gratifying to know that the Bromsgrove Company's business had flourished so well under his management, and it was particularly pleasing to hear that his street lighting had been so successful.

Mr. WOODFINE seconded the vote, which was carried with acclamation, and acknowledged by the President, who remarked that he and his Chairman and Directors were much looking forward to the visit of the Association to Bromsgrove.

The remainder of the meeting was devoted to a useful discussion on the provision of flues for gas appliances, which was opened by Mr. Rogers, who remarked that his notes had been got together very hurriedly, at the special request of the President.

Presidential Address of Mr. A. Bird.

[Midland Association of Gas Engineers and Managers.]

First let me thank you for the honour you have done me in electing me as your President for the ensuing year—an honour which, I assure you, I highly appreciate.

The Midland Association has been privileged by having many distinguished men as Presidents in past years—men who have left a deep impression upon the industry and rendered invaluable services alike to this Association and to the national organizations with which we are connected. It will be my endeavour to continue to the best of my ability the work they have initiated and developed, and I feel sure that any shortcomings on my part will be received with a kindly eye, knowing I can look for the ungrudging support of the members generally, and the tactful guidance of our Hon. Secretary. I venture therefore to anticipate a comfortable and useful year's activity such as will uphold the prestige of the Midland Association. So, with your indulgence, I will begin with that most familiar to myself, and which, like the ideal application of charity, starts at home.

Early Days of Gas in Bromsgrove.

The Bromsgrove Gas Undertaking was acquired as a going concern from the then owners, Messrs. Dipple & Thomas, in the year 1869, when the make of gas was 5 million c.ft. per annum, and the late Mr. William North, who will be remembered by the older members as a sound practical Engineer, was the Manager.

I do not propose to take you in detail through the various stages of the growth of the undertaking, but am content to refer to it as it exists to-day. Straight coal gas is produced. I took over the management in the year 1894, when the make of gas was 20 millions; in 1914 the make was 71 millions, in 1924 104 millions, and in 1929 133 millions. Such, briefly, are the milestones of development of the undertaking it is my lot to control.

Carbonizing Plant.

The retort house consists of a horizontal retort bench of six beds, each filled with eight 22 in. by 16 in. D retorts 20 ft. long, arranged in three tiers, housed in a steel framed retort house, with chimney at one end, and complete with mechanical coal handling plant, continuous overhead coal storage hoppers, stoking machine, and generating plant. The retort settings are of the latest design, the furnaces being of Drakes patent regenerative system with step-grate type of fittings. For the more recent settings, the hanging bar type of fittings has been adopted. The clinkering floor is on the same level as the yard, with a stage floor on each side of the bench, for the retort charging and discharging operations.

At each side of the bench there are 6-in. diameter cast-iron ascension pipes, two to each retort, with separate hydraulic mains, gas offtakes, and tar outlets, to each bed. One 18-in. foul main is fixed centrally over the retort bench, with a retort house governor at the offtake end.

The tar mains are fixed underneath the hydraulic mains, with one tar tower at each end of the bench. Platforms are fixed alongside the hydraulic mains, with approaches from the stage floors, so that all gas and tar valves, retort house governor, &c., are easily accessible. The stage floors are formed of concrete arches between rolled-steel joists, and are brick paved on the top, with rails and supports on the charging side for the charging and discharging machine.

The coal plant consists of a 5 ft. square mild-steel receiving hopper, fixed on the ground level outside the retort house, with jigger feed and two-roll coal breaker fixed underneath, for passing the coal to the elevator boot after it has been suitably broken for carbonizing. The elevator, which is of the plated bucket-type, takes the broken coal up to the overhead storage hoppers in the retort house, these hoppers running the full length of the retort bench and having sufficient storage capacity for 60 hours' supply. The drag bar conveyor for distributing the coal over the entire length of the hoppers is carried on brackets fixed to the hoppers. The latter are fitted with sliding doors at the bottom, which are operated from the stoking machine. A Drakes combined charging and discharging machine travels in front of the retort bench, and is electrically operated, with charging and discharging, travelling, and hoisting motors. An electrical generating plant for supplying the mechanical plant and stoking machine is fixed underneath the stage floor. The retort house is of steel frame construction, with brick panelling between the rolled-steel joist stanchions; the roof being slated. One end is of temporary construction, and may be readily removed for extension. A coal store is erected along the side of the retort house on the elevating side.

During last year one boiler, exhausters, and condensers were removed to a site near the retort house, and a new 50,000 c.ft. per hour exhauster and a Holmes super horizontal condenser were added. The water supplying this condenser is taken from an overhead tank which supplies the works, and the water returns into another tank which supplies the furnaces of the retort settings. Therefore no more water is used than before adopting this condenser. An additional boiler has been set in the new house, fitted with Wilton's patent furnace. The fuel used is the refuse from the retort furnaces, and small coke dust. All the water supply, except that for drinking purposes, is pumped from an artesian well. The old retort house has been converted into a mess room, stores, fitters' shop, and smithy, a large store room extending over the whole of the house.

Storage.

There are two gasholders—one guide framed holder of 160,000 c.ft. capacity, and one spiral holder of 350,000 c.ft. Some years ago a second lift was added to the latter holder, when it was weighted with cast-iron blocks fixed to the vertical stays. It gives a pressure, when cupped, of 8½ in., and is kept cupped during the cooking load, which is the heaviest consumption of the day.

The manufacture of sulphate of ammonia is continued, not because it is a paying proposition, but because it is the least expensive way of disposing of the ammoniacal liquor.

The whole of the coal has to be carted from Bromsgrove Station, some 1½ miles away from the works. This is done by a 6-ton "Sentinel" wagon and other motor vehicles, but at the best is an expensive item of expenditure.

There are two governors controlling the supply to the district—one 15 in. supplying the north side of the works, and one 10 in. supplying the south side.

District of Supply.

The district of supply is very extensive for the annual make of gas, requiring over 50 miles of mains; and the altitudes over the district vary from 270 ft. to 950 ft. above sea-level. Unfortunately this does not mean that we have a gradual rise from 270 ft. to 950 ft., for the district is most uneven to work. In the case of the 950 ft. height, there follows a sudden drop, in about one mile, to 630 ft., where is situated the largest modern housing estate in the district.

The district generally is residential, there being only one large consumer—viz., the London, Midland, and Scottish Railway Company, who have large repairing works at Bromsgrove. Therefore most of the consumers are what would be termed small and "domestic," and in no sense "industrial." The general policy of the Company towards their consumers is that of simplicity. Nothing but ordinary grade cookers are put out on hire, slot cookers are free, and higher-grade cookers are sold at list price or on attractive hire-purchase terms, and fixed free. Gas fires, boilers, &c., are sold at list price, and fixed free. We have no so-called free system of maintenance; whatever is supplied to the consumer is charged out at cost price, and this, in our particular circumstances, appears to be quite satisfactory to all concerned. A showroom in the town, for the convenience of consumers, seems to be appreciated, and certainly is most useful.

All told, we have 4150 consumers, 1450 being supplied through ordinary meters, and 2700 through slot meters. Together, these consumers have in use 3100 cookers; in addition, we have a very large number of gas fires, wash-boilers, and other apparatus, of which we have not sufficient record, owing to the goods being sold, and not hired.

Among other uses in which gas continues to hold its own at Bromsgrove is street lighting; and it is very satisfactory to know that the Company's efforts in this direction are appreciated by the public.

Street Lighting.

Bromsgrove being situated on the main highway from Birmingham to Worcester, a great volume of road traffic is constantly passing through, both day and night, and it has been realized for some time that good lighting of the main road, which runs through the centre of the town, is imperative. Consequently considerable attention has been given to the subject, and the present system is the result.

The Gas Company retain all the public lighting, and satisfaction has been expressed alike by motorists and pedestrians.

At the most important junctions, each lantern is fitted with six No. 2 mantles. Throughout the main street lanterns are fitted with four bijou mantles placed in alignment, this alignment being at right angles to the line of the roadway. All these lanterns have been raised by adding an extension piece 1 ft. 6 in. on to the ordinary columns, which has added greatly to the lighting effect and conforms with the British Standard Specification for Street Lighting—namely, 13 ft. 6 in. from ground to point of light.

The lanterns in the remaining streets are fitted with two No. 2 mantles. The whole of the lamps are fitted with clock-work controllers. Not only have these improvements rewarded the Company by the resulting satisfaction to all concerned, but have proved to be a good advertisement for incandescent gas lighting.

We may turn for a few minutes from the particular to the general. You do not wish me, nor do I intend, to wander over the vast field of gas administration and practice, but I would take this opportunity of briefly commenting upon one or two topics of current interest to the industry.

The Royal Charter.

Much has been said and written about the Charter of Incorporation recently granted to the Senior Organization of the Industry—viz., the Institution of Gas Engineers. I do not intend to dilate upon it in any way, but there is one aspect of the subject which seems to me worthy of note—viz., that the meaning of the term "gas industry" has been authoritatively defined in the by-laws accompanying the same, according to which the "gas industry" means—

(*a*) The manufacture or distribution of town gas.
(*b*) The design or construction of works machinery, plant, or apparatus for the manufacture, distribution, or use of town gas.
(*c*) The manufacture or working-up of bye-products by gas undertakings.
(*d*) Research work connected with the manufacture or distribution of town gas, or its application.

This definition, taken in conjunction with the necessary qualifications of candidates for Membership or Associate Membership of the Institution, enables us to arrive at some more definite idea of what a "gas engineer" is supposed to be. A great deal will depend upon the interpretation put upon these by-laws by the Council from time to time, with regard to the admission of new Corporate Members; but the general effect would appear to be a narrowing of the opening for the non-technical class on the one hand, and, on the other, a widening of the doorway so far as the technical class is concerned, more especially in the engineering domain. The effect of this latter will surely be the admission of the best men engaged within the four sections set out in the definition of the "gas industry;" and it has long been felt that their presence in our leading technical organization was highly desirable, and bound to result in benefit all round. There is no doubt the time is upon us as an industry when the co-operation and co-ordination of all the forces at command is a first essential, and anything which tends to greater unity and joint endeavour is to be encouraged.

The much discussed and amended Education Scheme is, of course, very closely allied with the status of the future Membership of the Institution. The two inseparably hang together; and now that the Education Scheme Rules have been amended to suit the Charter requirements, it behoves all technical chiefs and administrators to help forward the application of the Scheme to the fullest extent their means and circumstances will allow.

Anyone taking a dispassionate survey of the industry as it stands to-day is bound to admit the inequity of the claim that any one of its sections or departments is of more vital importance than another. A brief comparison of salary and wages allocations of to-day with those of (say) 25 years ago is a striking commentary upon the altered conditions existing. As a matter of fact, if the best results are to be achieved, all sections or departments must work together to the one end, and not simply "union," but "unity," must prevail.

The most striking example of this change in requirements and conditions is provided by the formation and progress of the Salesmen's Circles, fostered by the "B.C.G.A."—a development which no one could have anticipated at the time the "B.C.G.A." was launched some eighteen years ago. It is a tonic and an inspiration to attend a conference of delegates of these Circles, and would put heart into many a work-weary chief could he but attend them.

Salesmanship and Service.

Gas undertakings have, for far too long, relied upon the quality and utility of their main commodity to recommend it. Properly considered, it is not a question of merely boosting their wares that is required, but the putting intelligently before consumers, actual and prospective, of the multifarious purposes and uses to which gas can be applied, and applied to their advantage—with which is bound up the duty to acquaint, instruct, and even educate the consumer of gas, and users of apparatus, in the most efficient and economical service to be obtained from this medium of light, heat, and power. The watchword of the entire industry has become "service;" and no part of the service, from raw production to the last word in efficiency in use, can be neglected with impunity.

Salesmanship has established itself as one of the essentials in this "complete service," and involves an amount of technical knowledge and experience little realized at first view. Salesmen, whatever title they may be given, are the real live connection between the gas supplier and its public, and much of the success of an undertaking depends upon the impression they make upon the minds of their patrons. The Gas Salesmen's Circles have made excellent progress since their inception, and are destined, in my opinion, to give a still better account of this branch of gas service in the near future, particularly if they are fostered to the extent their importance warrants.

In conclusion, let me say that it gives me much pleasure, on behalf of my Chairman and Directors, to extend to you a cordial invitation to visit Bromsgrove in May next, upon a date to be arranged to suit your convenience.

Comparative Costs of Fuels for Domestic Purposes.

By A. H. Barker, B.A., B.Sc., M.Inst.C.E.

[From a Lecture before the Joint Gas Conference, Birmingham, Feb. 19.]

(*Concluded from p.* 646.)

SECTION V.—COOKING EXPERIMENTS.

To make fair and reasonably accurate comparisons between the costs of different methods of cooking is, perhaps, the most difficult part of such experiments as this. We are here principally concerned with a practical comparison between the cost of cooking by gas and by electricity in the hands of expert cooks. One of the principal difficulties is the comparative slowness of the electrical equipment. In a busy domestic establishment rapidity is a matter of vital importance, and in this particular establishment it has always been difficult to ensure that, at times of stress, the cook did not use the available adjacent coal stove or gas rings to supplement the electric hotplate when it was desired to boil something quickly or to boil a very large vessel which, with an electrical hotplate, it is impossible to boil at all.

During the first portion of these experiments this kitchen was provided with a range of the "Cookanheat" type, in which a coke fire was maintained for purposes of hot water supply and heating. This gave facilities for boiling kettles, heating plates, and the like operations. It was frequently found that kettles, pans, plates, and other things were placed on this range by the cook at times when the whole of the cooking was supposed to be done by electricity.

Several such uses of the range would obviously throw the whole observations into a region of uncertainty. On the other hand, when the gas cooker was in use, it was even more convenient to boil kettles or other vessels on gas rings than on the solid fuel range. Hence the gas cooker, in these circumstances, did more work than did the electric cooker; and a fair comparison between them was, therefore, vitiated. This is an example of the difficulty of conducting such comparisons as are here attempted in a busy private house.

Apart from the cost, the principal practical objection to the electrical equipment is its slowness. Electrical ovens take much longer to attain a cooking temperature than do the gas ones, and the hotplates are also very much slower. Table IX.

Table IX.—*Comparison of Gas and Electric Cookers used for Heating of Water 60° to 200°.*

On Hotplate.

[Machined-Bottom Aluminium Saucepan. Weight, 2·375 Lbs. Weight of Water, 5 Lbs.]

Stove.	Fuel Rate per Hour.	B.Th.U. per Hour.	Time Occupied Minutes.	Amount of Fuel Used.	Cost in Pence.	Percentage.
Gas. . . .	21 c.ft.	10,500	12	4·2 c.ft.	0·21	100
Electric . .	1600 watts	5,500	19	0·53 unit	0·53	254

In Ovens.

[Weight of Iron Saucepan, 2·7 Lbs. Water, 4·31 Lbs.]

Gas. . . .	20 c.ft.	10,000	48	1·3 c.ft.	0·65	100
Electric . .	2700 watts	9,200	47	2·73 units	2·72	420

shows the results of actual experiments on both ranges. It is to be observed that the action of the " Regulo " device on the gas cooker caused the rate of rise of temperature in the gas oven to be constant, whereas the gradual accumulation of heat in the electrical oven caused the rate of rise to increase, which really means that the electrical oven would have burnt the food if the full power had been left on, but the gas one would not.

The reason for the greater rapidity of the gas heated hotplate is fairly obvious. As soon as the gas is lighted the full heat at once impinges on the vessel to be heated, but switching-on of an electrical heating plate involves a preliminary heating up of a mass of material which has to be raised to a high temperature before any effective result is observable on the vessel. When the gas is switched off, the production of heat immediately ceases. With an electrical boiling burner the mass of material which has had to be raised in temperature is still hot and its heat can be used by continuing the heating after the power is switched off. When the operations are continuous for a long period the effect of the heavy time lag of the electrical outfit is less apparent, and in some cases the uniform effect of an electric hotplate is even superior in convenience to, but always more expensive than, a gas-heated one. In the great majority of cases the heavy time lag and the low maximum heating power of the electrical outfit make it both less convenient and less adaptable than the corresponding gas appliances for a private house.

The reason for the comparative slowness of the electric ovens can be readily seen by the comparison of the power available. If it is desired to heat a gas oven rapidly, as always is the case when any cooking is to be done, the burners can be turned on full, burning at a rate of (say) 36 c.ft. per hour, corresponding to 18,000 B.Th.U. per hour, which will be automatically reduced by the excellent " Regulo " device when the oven is at an adequate temperature, so there is no need to be afraid to turn on the full power when heating up.

The electrical oven had a maximum capacity of 2700 watts, corresponding to 9180 B.Th.U. per hour. It would require an unheard-of loading of 5200 watts to equal 36 c.ft. of gas. It is obvious, therefore, that the heating up must be much slower with this relatively small power which usually cannot be increased without laying another cable and incurring the risk of serious overheating and waste. This fact of the slowness of practicable electrical cooking tends to increase the relative cost of gas as compared with electricity. It is well established that the greater the facilities afforded by any apparatus, the greater in almost all cases will be the waste. If it were possible, which it is not, the comparison ought therefore to allow for the cost of the additional time spent by the staff when the cooking is done by electricity, and the additional waste due to the greater power of the gas plant.

On the other hand the practical result of slow cooking is in some cases superior to rapid cooking. In others the opposite is the case. It is difficult or impossible to express that in terms of cost. These considerations will suffice to illustrate the great difficulty of making adequate comparisons.

An electrical griller is, however, usually more rapid than is a gas one for the same reason—namely, that the electrical elements do not require to heat up a mass of metal before they begin to radiate their heat as gas ones do. An electric griller is therefore superior to a gas one in this important respect. Further, if the full electrical power, inadequate though it may be for rapid heating up, is left on for an unnecessary length of time, the temperature of the oven gradually rises until it is much too high, which involves a waste of electrical power, and of time, and probably some loss in damaged food. Similar troubles can arise in connection with the hotplate, and if the current is left on, without a vessel, or an electrical kettle without any water in, the electrical apparatus may be damaged, or some fuse may require to be replaced.

With a gas burner, on the other hand, no such damage is caused. With an electrical cooker one cannot see whether any, or how much, power is turned on without reading the inscriptions on the switches. With a gas cooker one can see at a glance how big the gas flame is or if the flame is out. In the event of any untoward happening, such as would cause any electrical elements to be put out of action, or any loss of insulation resulting in an electric shock, the cook is at once at a loss, and cannot proceed with the operations until an electrician has been called in. It may upset entirely the progress of important cooking operations such as the preparation of a festive dinner. The thing is a mystery to her. One shock is sufficient to frighten a nervous woman so much that she can hardly be persuaded to use the apparatus at all.

A gas burner, on the other hand, is a perfectly straightforward appliance. The only thing liable to go wrong with it is that it gets dirty, and if improperly used may go off with a bang or make a smell; but with ordinary common sense and a little bit of soda, the cook can keep it in proper order.

On the other hand, there is a universal agreement among those who have used electric ovens that, once heated up and in proper order, and if properly adjusted, the cooking effect of an electric oven is as near perfection as is attainable, though not superior in practice to a well managed and well designed gas oven. It is cleaner and less smelly. A gas oven must always suffer by comparison because of the inevitable products of combustion which carry heat and fumes away with them. It is of no use to shut our eyes to this obvious fact. Though they do no particular harm, they are a definite drawback of a gas cooker as compared to an electric one.

In order to get over the practical difficulties, I had the " Cookanheat " plant entirely removed and the gas entirely cut off while the electrical plant was in use, and *vice versâ*, so that the staff were compelled to use only the electrical plant or the gas plant as the case might be; and the experiments were repeated. The cost of the electrical power was greatly increased in these conditions. The principal difficulty in this busy household has been that the three very competent cooks who used these appliances all preferred the gas cooker to the electrical one, and the periodical change-over to the exclusive use of electrical cooking in place of gas has always been reluctantly undertaken, though for certain of the operations the electrical devices were preferred.

The comparisons in this case have been made in several different ways. With a cooker it is possible to make tests of the laboratory order with very simple appliances. An accurate gas or electric meter, and a cooker in good condition can be

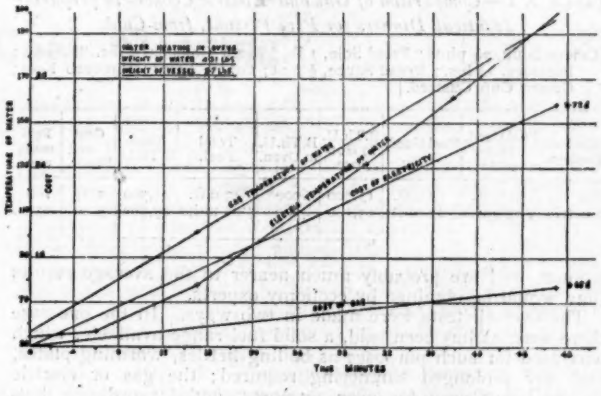


Fig. 1.—Water Heating in Ovens.

used in a variety of ways to obtain accurate results. I have included some such comparisons in the present series. I have also had many identical meals, the constituents of which were accurately weighed out, prepared both on the gas cooker and on the electric outfit, the results of which are given. I have, further, compared the two on the third principle, by having the whole cooking of the household done electrically, and also by

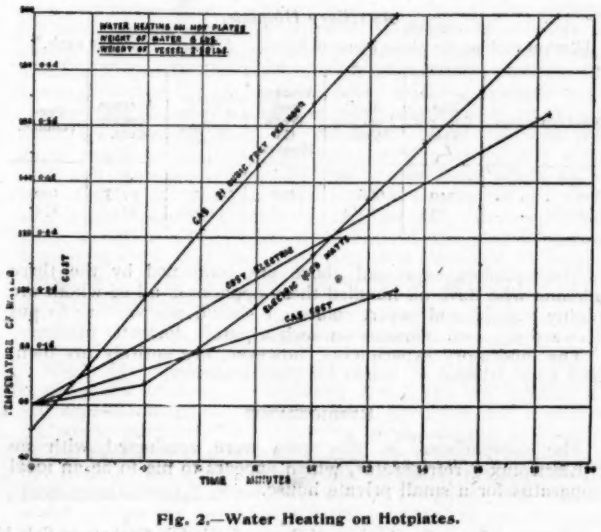


Fig. 2.—Water Heating on Hotplates.

gas, over long periods and taking the reading of the meters every week. These have been done in two ways with and without the coal range available.

From these three series it is possible to arrive at a fairly accurate idea of the relative costs, in actual practice; and these are given, as nearly as I am able to calculate them, in the

accompanying tables. It is, of course, possible that if fuel economy experts on either side had been in charge of the experiments the results might have been modified, but probably not materially. These operations were conducted in the ordinary course of business by expert and reasonably economical

TABLE X.—*Comparison of Gas and Electric Cookers in preparing Breakfast, from Cold, for One Person.*

[Bacon, Sausages, Toast, and Tea.]

—	Fuel Used.	Time Occupied from Cold to Dishing-up.	B.Th.U. in Fuel Used.	Cost of Fuel in Pence.	Percentages.
Gas	8 c.ft.	12 minutes	4,000	0·4	100
Electric	1·33 units	20½ minutes	4,500	1·33	333

For Five Persons.

[Same Menu.]

Gas	41 c.ft.	15 minutes	20,500	2·05	100
Electric	3·7 units	25 minutes	12,600	3·70	180

TABLE X A.—*Comparison of Gas and Electric Cookers in preparing Identical Dinners for Five Persons, from Cold.*

[Celery Soup, 2½ pints; Fried Sole, 1 lb.; Roast Chicken, 2 lbs. (trussed); Potatoes, 1½ lbs.; Bread Sauce, ½ pint; Gravy, ½ pint; Rhubarb Fool; Cream Cup Custard.]

Kind of Cooker.	Fuel Used. Hotplate.	Fuel Used. Oven.	B.Th.U. in Hotplate.	B.Th.U. in Oven.	Total Fuel.	Total B.Th.U.	Cost in Pence.	Percentage.
Gas	31 c.ft.	12 c.ft.	15,500	6000	43 c.ft.	21,500	2·15	100
Electric	3·85 units	1·23 units	13,100	4200	5·08 units	17,300	5·08	237

women, and are probably much nearer to the average results than would be obtained by economy experts.

The over-all tests were made in two ways. In the one case there was, as has been said, a solid fuel range available, which was used for such purposes as boiling kettles, warming plates, and any prolonged simmering required; the gas or electric cooker being used for oven purposes, and for ordinary hotplate work.

It has been pointed out that this series was regarded as unsatisfactory, because of the uncertainty attending the amount of work done on the "Cookanheat" range, and also the certainty that, owing to the slowness of the electric hotplate, a great deal more work was done on the "Cookanheat" when the electric appliances were in use than when the gas was in use. This comparison, therefore, gives a distinctly unfair advantage to the electrical system. This accounts for the difference between the two tables.

TABLE XI.—*Comparison of Gas and Electric Cookers with Auxiliary Hotplate.*

[Cost of cooking for whole house (6 hours). Average, 13 weeks each.]

Kind of Cooker.	Min. Fuel per Week.	Max. Fuel per Week.	Average per Week (13 Weeks).	Average B.Th.U. in Fuel Used.	Average Weekly Cost.	Percentage.
					d.	
Gas	340	668	490	245,000	24·5	100
Electric	33	60·4	42	143,000	42	171

The opinions expressed above are confirmed by the three persons who have all handled these appliances all of whom are highly trained and expert cooks. I should not venture to put forward my own opinions on such a purely domestic matter.

The laboratory experiments, however, are entirely my own, and I can, therefore, vouch for their accuracy.

REFRIGERATOR.

The comparisons in this case were conducted with an "Electrolux" refrigerator, which appears to me to be an ideal apparatus for a small private house.

TABLE XII.—*Comparison of Gas and Electric Cookers.*

[Cost of Operation for One Year.]

—	Total Fuel Used in Hotplate.	Total Fuel Used in Oven.	Total Fuel.	B.Th.U. in Fuel Used.	Total Cost.	Percentage.
					£ s. d.	
Gas	42,500 c.ft.	13,500 c.ft.	56,000 c.ft.	28,000,000	11 12 0	100
Electric	4,400 units	1,100 units	5,500 units	18,000,000	23 0 0	198

TABLE XIII.—*Use of "Electrolux" Refrigerator.*

Fuel.	Amount of Fuel Used per Week (Continuous Use).	B.Th.U. in Fuel Used.	Relative Efficiency of Use. P.Ct.	Cost per Week.	Percentage Cost.	
				d.		
Gas	595 c.ft.	298,000	70	29·8	100	49·5
Electricity	60·2 units	206,000	100	60·2	203	100

TABLE XIV.—*Practical Equivalents of Coke, Coal. Gas, and Electricity as Deduced from these Experiments.*

Coke. Tons or Lbs. 12,200 B.Th.U. per Lb.	Coal. Tons or Lbs. 14,200 B.Th.U. per Lb.	Gas. C.Ft. 500 B.Th.U. per C.Ft.	Electricity. Units. 3410 B.Th.U. per Unit.	Equivalent Price per Unit of Electricity = to Gas at 10d. per Therm.
GROSS EQUIVALENTS OF HEAT GENERATED.				
1 ton	0·86 ton	55,000	8000	0·33d.
41 lbs.	35 lbs.	1,000	146	
0·28 lb.	0·24 lb.	6·9	1	
HOUSE WARMING.				
(a) Central Heating.				
1 ton	..	35,000	4000	0·44d.
64 lbs.	..	1,000	115	
0·56 lb.	..	8·8	1·0	
(b) Open Fires.				
..	1 ton	21,500	1420	0·75d.
..	104 lbs.	1,000	66	
..	1·6 lbs.	15	1·0	
HOT WATER SUPPLY.				
1 ton	..	31,500	3500	0·45d.
71 lbs.	..	1,000	112	
0·61 lb.	..	9·0	1·0	
COOKING.				
(a) Small Isolated Meals Cooked from Cold.				
..	..	1000	166	0·3d.
..	..	6·0	1·0	
(b) Large Meals.				
..	..	1000	118	0·425d.
..	..	8·5	1·0	
COOKING FOR WHOLE HOUSE.				
(a) With Auxiliary Hotplate Available.				
..	..	1000	86	0·58d.
..	..	11·6	1·00	
(b) Entire Cooking with no Auxiliary Hotplate.				
..	..	1000	98	0·51d.
..	..	10·2	1·0	
"ELECTROLUX" REFRIGERATOR.				
..	..	1000	102	0·49d.
..	..	9·8	1·0	

TABLE XI.A.—*Comparison of Gas and Electric Cookers as Sole Means of Cooking for House of 5-6 Persons. Average, 15 Weeks each.*

Kind of Cooker.	Hotplate.			Oven.			Total.			B.Th U. in Fuel per Week.	Cost in Pence Per Week.	Percentage.
	Min.	Max.	Av.	Min.	Max.	Av.	Min.	Max.	Av.			
Gas	610	930	820	160	350	256	900	1305	1076	538,000	53·8	100
Electric	73	85·3	84·2	15·7	27·1	21·3	97	110	105·5	360,000	105·5	197

The table shows the results of these experiments, from which it will be seen that to operate the apparatus electrically costs twice as much as by gas.

Here again there is the characteristic difference which has always to be taken account of between the two agents, in that electricity does not generate any products of combustion, while gas does. In the present case means have been adopted for discharging such products as there are into an adjacent chimney, so that they do not find their way into the pantry where the apparatus is fixed. This is a provision which, though not strictly necessary, is an improvement. The small amount of products of combustion does not do any appreciable harm even when introduced into the air of the room where the apparatus is fixed, but it would undeniably be better if they were not there. In such a case—as in most cases—one has to offset the disadvantage of the products of combustion by the advantage of low operating costs. Such allowances have to be taken into account in every case.

SECTION VI.—SOME OPINIONS.

The results emphasize more than ever, in my mind, what I have always believed, that electricity and gas ought not to be regarded as rivals in the service of the public, but as complementary to one another.

There are, quite unquestionably, spheres where any impartial person cannot fail to see that electricity is superior to gas. There are equally spheres where to substitute electricity for gas is not only a waste of the consumer's money, but also of the fuel resources of the nation. Yet others where the substitution of either gas or electricity for coke is a plain extravagance in both respects.

I am looking forward to the time when there shall not be a separate electricity supply authority and a gas supply undertaking and coke merchant in one area, but that all shall be parts of the same amalgamated company, and that all members of the staff shall be equally trained in the proper use of all, that the waste and spare products of the gas-works shall be used to generate the electric supply, and that all the resources of the company shall be combined not only to make a profit for the shareholders, but to serve the customer with cheap gas, cheap electricity, and cheap coke—all of which should be carried to every house. We hear much in these days about the advantages of what is called rationalization of industry. I venture to say that there is no single example in the whole of industry where the advantages of that process would be so conspicuous as in this.

Problems in Coal Cleaning.

The subject was discussed at a joint meeting of the Society of Chemical Industry and the Institute of Fuel on Thursday last. The meeting was held in the Chemical Department of Bristol University; when F. S. Sinnatt and D. T. Davies presented a paper entitled "Some Developments and Problems in Coal Cleaning." The authors said: It has been observed that Great Britain has lagged behind the Continent in the application of methods of coal cleaning. This is not a correct view of the situation. The coals of Great Britain are found in seams which are usually extremely pure and free from ash. The result has been that the application of cleaning processes in the past has not been so necessary as on the Continent, where the coals are less pure. The proportions of the types of coal required by industrial concerns are gradually changing. The methods used in the mines for the removal of small coal are increasing in efficiency, and thinner seams have to be worked. These facts have brought about a greater application of coal cleaning. It is clear from the statistics that the coal industry, especially in certain of the coal areas, has fully appreciated the situation, and is taking adequate steps to meet present-day and future requirements.

DR. LESSING'S PROCESS.

Having called attention to the rapid growth of dry cleaning during the last seven years, the authors went on to say that one of the most striking processes which has been developed recently in wet washing is that invented by Dr. Lessing. This process consists in the application on a large scale of the principle of the float-and-sink test so widely used in the examination of coal, and thus permits cleaning results being obtained in close agreement with theoretical washability curves, both as regards ash percentage and yield of clean coal. An important feature, if not an essential one, of Dr. Lessing's technique consists of the most efficient removal of the dust before the coal is subjected to treatment in the actual gravity separation plant.

The recognition by Dr. Lessing of this fact is an important step in coal washing, and there is little doubt that other washing processes would be improved, from the point of view both of cleaning efficiency and of the subsequent drainage of coal, and the simplification of the slurry problem, if a similar technique were applied to the coal before it enters the washery. The dust separated in the Lessing process is marketed in the raw state, and it has been necessary to devise suitable railway wagons to handle this fine dust.

BAUM WASHER WITH AUTOMATIC CONTROL.

The authors quoted an example of experiments on an automatically controlled Baum washer at the Fuel Research Station. Slack containing 21·3 p.ct. of ash has been treated; the resulting clean coal was found to contain 3·7 p.ct. sink material, with a loss of 0·6 p.ct. float material in the dirt. These results were obtained in a trial extending over a day, and no adjustment in the control was made once the correct setting had been found.

TREATMENT OF SLURRY AND WASHERY WATERS.

The treatment of slurry and of washery waters has not received the attention it deserves from a chemical and physical point of view. Experiments were carried out on the use of flocculating agents by Slater, Simpkin, and another, and it was found that, if small amounts of calcium hydrate, aluminium sulphate, sodium aluminate, sodium silicate, caseine, glue, gelatine, or albumin were added to washery waters, flocculation occurred which facilitated the settlement of the solids in suspension. The amount of reagent required varied from 1 lb. in the case of lime or aluminium sulphate to as low as 0·2 lb. of gelatine or glue per ton of solid recovered. The solids in the washery water treated ranged from 1-5 p.ct.; consequently, the amount of reagent to be added is extremely small in relation to the total liquid to be treated. By adding certain of the reagents under precise conditions it was found possible to bring about a fractional precipitation of the coal and the dirt from the washery waters.

In view of the above, many problems connected with fine coal still await investigation: (*a*) The purification of the coal with the dust present, (*b*) the efficient removal of the dust, (*c*) the purification of the fine coal with the associated problem of drying, and (*d*) the purification of washery water.

Work is in progress at the Fuel Research Station on this problem, and in the near future an investigation will be commenced on the Elmore vacuum flotation method of purifying fine coal.

ULTRA-CLEAN COAL.

Increasing interest is being taken in what may be termed ultra-clean coal, and areas in which pure coal seams occur are gaining a certain advantage. Coal is at present being sold containing only 1·2 to 1·5 p.ct. of ash. If the demand for such special products increases, it should be possible to obtain such coal not only from special seams, but from many average seams, by the manipulation of ordinary washers, the Lessing method, or by working other washing systems—e.g., concentrator tables—in such a manner that three or more products are recovered from the raw coal. The suggested products would be at least three—viz., dirt, commercially clean coal, and ultra-clean coal. By this system there would be no loss of the yield of clean coal, but one fraction of the clean coal would assume a special significance—viz., ultra-clean coal. This would be taken from a portion of the coal of lowest specific gravity, and the proportion it is desirable to recover would be decided by a study of the specific gravity, analysis, or washability curves.

ELIMINATION OF SULPHUR.

The whole question of the elimination of sulphur from coals is of special interest, as obviously the lower the sulphur the less contamination of the atmosphere when the coal is burned for power purposes. Some portion of the sulphur is retained in the clinker and ash, and, though its presence may reduce the value of the clinker for certain purposes, it decreases the proportion of sulphur escaping up the chimney. The factors which govern the retention of sulphur in clinker are not clear, but among them the chemical composition of the ash plays a part. It would appear that the ankerites, which contain carbonates of calcium, magnesium, and iron, favour the retention of the sulphur in the clinker or ash. This suggests that one method of preventing the emission of a proportion of the sulphur dioxide is either to retain the ankerites in the coal or to add chalk, magnesite, &c., to the commercial grades.

The retention of sulphur by calcium and magnesium may lead to misleading ash contents in washery products, since the

distribution of the mineral constituents and the sulphur may be altered so that the fixation of sulphur is increased or reduced in some particular fraction. When the percentage of ash is determined in each of the products, a fraction rich in sulphur, calcium, and magnesium may, under favourable conditions, yield a higher percentage of ash than is actually present owing to the retention of a larger proportion of sulphur. This phenomenon may be one of the factors in the difficulty encountered in obtaining ash balances from washeries.

Some consideration must be given to the amount of chlorine in coal before deciding upon the system of cleaning to be adopted. In the past the question of chlorine has been of particular interest to those engaged in the manufacture of coke, but coal suitable for steam raising not infrequently contains fairly large percentages of chlorine. Chlorine occurs combined with the organic substance of coal and as chlorides of sodium and magnesium, &c. The amount present may vary from one locality to another in the same seam, and in one particular instance a seam was found to contain from less than 0·1 p.ct. of sodium chloride at one place to over 1·0 p.ct. in a neighbouring locality. Our knowledge of the rôle played by chlorine during the combustion of the coal in furnaces is incomplete, but since in certain cases it may be highly desirable to reduce the amount of chlorine in the cleaned grades, it is obvious that dry cleaning methods are not so suitable as wet. The only practical method of removing the salt from coal is by solution in water. When such coals are being treated, it necessitates frequent renewal of the whole of the washery water.

Provision of Flues for Gas Appliances.

A Discussion introduced by Mr. R. J. ROGERS, Chief Superintendent, Fittings Department, City of Birmingham Gas Department.

[Midland Association of Gas Engineers and Managers.]

From the outset I wish to make it clear that I do not propose to give a paper on the ventilation of gas appliances. It is a subject that has been dealt with at various meetings of the technical and sales organizations of the gas industry in the past few years, and one that I consider merits the careful attention of the industry. The future prosperity of the industry will depend to a large extent on the use of gas as a fuel; and, in the application of gas for various heating purposes, the problem of the effective disposal of products of combustion requires special consideration.

I should like to congratulate Mr. C. A. Masterman on the excellence of his paper "Combustion, Wind, and Flue Equipment" read before the Institution of Heating and Ventilating Engineers on Jan. 8 last. One might almost say that this paper stands alone as a definite endeavour to find a proper scientific explanation of the various problems met with in the ventilation of gas appliances. It is a paper which should be carefully studied, as it is to such research work that we must look for guidance in approaching the various problems of ventilation which we may have to solve in the future. In the meantime I propose putting forward a few of my own personal experiences to serve as a basis for our discussion this afternoon.

Any consideration of domestic ventilation must start with the chimney, and I think experience will show that, in spite of any attempts the gas industry may have made to supersede it, the chimney, as we have known it for generations past, will prove the most practical solution of our flue problems. The earliest attempts at securing a measure of comfort inside rooms in the cold periods of the year were dependent on some method of heating. The early history of the domestic chimney is most interesting, and the need for the provision of chimneys had a great effect on early domestic architecture in this country. Whereas many architects to-day look upon the chimney as an excrescence, we find that early designers—in the Tudor period, for instance—relied very largely on the chimney for decorative effect. Both in this country and on the continent the fireplace was the dominating feature in any scheme of interior decoration, some of the finest craftsmanship of the early workers being lavished on it.

With the advent of gaseous heating it was felt—and to a degree rightly felt—that alteration might be made in the construction of the chimney in view of the smaller volume of products that had to be evacuated, and the absence in them of smoke and solid matter. While favouring the smaller flue for dealing with products from gas appliances, the advocates of these so-called "economy" flues never intended for one moment that this should interfere with the important primary need of any successful chimney—a suitable termination above the ridge of the building.

Unfortunately, however, the suggestion of a saving in building costs was seized on by certain builders and architects, and interpreted to mean that any kind of flue terminating in any position was good enough for a gas appliance. While we have been able to arrange for suitable flues to be provided in the majority of houses erected in our area of supply, there have been isolated cases where we have experienced difficulty in prevailing upon builders and architects to provide satisfactory flues.

In opening this discussion I propose, therefore, to refer very briefly to a few of these difficulties.

Airbrick Below Eaves.

The practice of discharging a gas fire flue through an airbrick below the eaves of the house is one which seems to appeal to most architects. It certainly eliminates the stack, and is cheap; but unfortunately we have never found such flues to function properly under all conditions. Obviously when the wind is blowing against the airbrick it is impossible for the products of combustion to be discharged outside the building. The fixing of a certain type of side outlet has in some cases been fairly successful, and the gas undertaking have had no option but to connect gas apparatus to such terminals. We have always pointed out, however, that such a termination cannot be considered good practice, and advocated the carrying of the flue above the eaves' level.

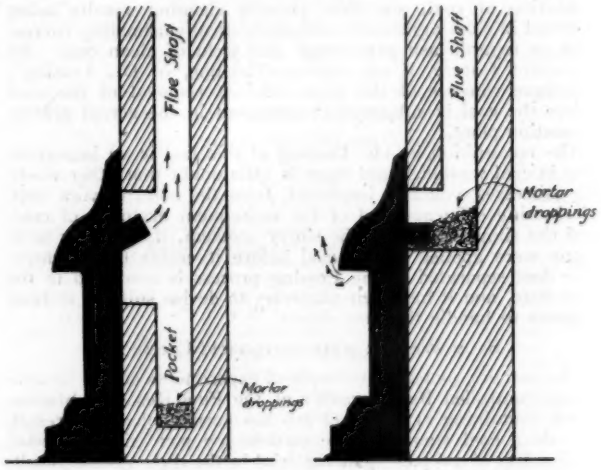
Two Flues Into One.

Generally speaking, each apparatus should have a flue separate through its entire length, terminating above the eaves. We have occasionally found places where 9-in. by 9-in. coal flues from rooms on the ground floor have been broken into in the bedroom for the purpose of connecting a gas fire flue, with the result that smoke from the coal fire has found its way into the bedroom.

On a housing scheme a short time ago we found that the contractor had in the first few houses joined two flues intended for gas fires in bedrooms into a common flue taken above the roof to a single pot. The danger of the products of combustion from the gas fire in use syphoning over into the adjoining bedroom was pointed out, and the flues were afterwards run separately, as they have been in every subsequent housing scheme.

Pockets for Mortar Droppings.

The provision of a pocket or extension of the flue below and at the back of the outlet on the gas fire is most important, as there is otherwise a danger of the flue outlet becoming choked by mortar and sand dropping down the chimney.



We were unfortunate enough to have in Birmingham last year a double fatality due to a stopped gas fire flue. In this case the space at the back of the fire had been bricked up as far as the level of the flue nozzle. Falling mortar had settled

on the top of this brickwork and ultimately covered over the flue opening from the fire proper.

I saw an account of what was evidently a similar accident near Crewe last month. In this case the flue from an anthracite stove was blocked at the point at which it entered the chimney with perished mortar and sand, and two women died from carbon monoxide poisoning.

FLUES IN ROOF SPACE.

We have had a few cases where builders have discharged bedroom gas fire flues into the roof space. In some cases the products of combustion have been successfully removed, but in other cases a definite downdraught has been experienced. Personally, I resolutely set my face against this method of flue construction, because, quite apart from the question of downdraught, I do not consider that such a flue can possibly perform the twofold duty we ask from any bedroom flue—namely:

1. To remove products of combustion.
2. To assist in the normal air change of the room.

In our English home the chimney has always been expected to, and does in practice, perform this double duty, and when a satisfactory chimney is installed, it can be looked upon as the costless ventilator—which functions every minute of the 24 hours.

BY-LAWS.

The attention of our City Engineer and Surveyor was called to the matter of these side outlets for gas fires, and the following Clause is now included in the Building By-Laws of the City:

Clause 74.

> Every person who shall erect a new domestic building and shall, for the purpose of heating any habitable room therein, provide a gas fire or other similar apparatus shall, for the purpose of securing the ventilation of such room, construct an adequate flue in connection with such gas fire or apparatus to discharge above the roof by means of a chimney or other suitable outlet.

Our inspectors of new buildings co-operate with the district building surveyors to ensure that the above by-law is observed. We are, however, still without any jurisdiction in large portions of our area of supply which are not in the area of the City of Birmingham.

In my opinion this by-law should be made to apply to every district in the country. Until this is made possible I suggest that every gas engineer should endeavour to arrange for flues from gas fires to discharge above the roof, and to take advantage of the first opportunity of obtaining amendment to the building by-laws of his district by a clause similar to No. 74 referred to above.

CONCRETE BLOCK FLUES.

The so salled "economy" flues of pre-cast concrete blocks have been used to a certain extent in Birmingham, but I am of opinion that, bearing in mind that the whole of the bricklayers' training has been in the use and bonding of his local bricks, it is unlikely that he will make so good a job in the new medium. Another difficulty is that the builder, hoping to save expense, will try to do without the special blocks for raking over and building in, and we are apt to get an unsatisfactory hybrid arrangement of concrete blocks and brickwork.

ANOTHER TYPE OF GAS FIRE FLUE.

An interesting arrangement of gas flues is one which has been carried out in a large number of houses by a firm developing several estates in our area. The two rooms downstairs (living-room and parlour) have 9-in. by 9-in. coal flues, and in the bedrooms above gas grates are fixed to 9-in. by 4½-in. flues in the brickwork carried up in the same stack above the roof and terminated with pots in each case.

We can say from experience that these 9-in. by 4½-in. flues, carried up as they are side by side with a warm 9-in. by 9-in. coal flue are quite satisfactory, and there appears to be a reasonable amount of ventilation up them from the bedrooms whether the gas fires are alight or not. I think it is most desirable that definite test should be carried out by an independent authority to find how far we can depart from the 9-in. by 9-in. flue and yet ensure that the flue will perform its dual purpose of removing all products and ventilating the apartment. I do feel that our experience over the last ten years should make as pause until we are quite sure how far we can depart from established practice in regard to sizes of flues, and yet leave a margin for efficient room ventilation.

It must be remembered also that a flue once constructed has to serve the needs of probably two or three future generations. I do not wish to set up as a prophet, but it may be that within the life of houses now being built the gas industry will be desirous of very largely increasing the sale of smokeless fuel for domestic use, and any very general departure from the 9-in. by 9-in. flue—which may be regarded as the minimum required by solid fuel fires—may prove a stumbling block for such expansion should it ever come about.

EFFECT OF EXCESSIVE PULL ON GAS GRATES.

We have experienced trouble of rather an unusual nature with some gas grates fixed on housing schemes. These were fixed to chimneys which had a strong natural updraught, and, as this could not be altogether satisfied *via* the flue outlet of the flue, a current of air was drawn through the fender, under the fuel guard, passing up the back of the fire. This current was strong enough to draw the flames downwards, so that the fuel did not become properly hot, and, owing to the breaking of the flame cone, a certain amount of partial combustion was evident. This difficulty can only be obviated by a careful examination of the gas grate before its adoption for use, to ensure that the grate is free from any opening leading to the back of the grate whereby chimney draught may exert a pull below the flames of the burners.

CONDENSATION IN FLUES.

A trouble of a very different nature which is sometimes experienced with flues is that of condensation. This is most pronounced in flues from circulating boilers and other thermostatically controlled apparatus, where a very small volume of gas is consumed, with the result that the products of combustion get cooled down too far before they escape from the chimney, and the moisture deposited soaks through the brickwork and appears as patches of dampness on the walls of the room. The obvious remedy is to keep the flue as warm as possible and lead the products by the shortest possible route to the open air. Where this is impossible the only other thing is to construct such flues of glazed earthenware, and make arrangements for the collection of the condensation at their base. Mr. C. A Masterman's researches into this question of condensation, some particulars of which appear in his paper to which I have already referred, are of the greatest interest.

GAS COOKERS.

The ventilation of the gas cooker resolves itself into two parts:

(1) Conveying products of combustion and steam from the oven.

(2) Removal of the products from the hotplate.

As you are all aware, no definite policy has been adopted by the industry in connection with the ventilation of gas cookers in domestic dwellings. In our area of supply, where consumers require a flue pipe connected from their cookers this is done free up to a reasonable length. In my opinion, architects and builders should be encouraged to provide a proper chimney from the scullery or kitchen in which gas cookers are to be fixed, so that the oven and hotplate if necessary can be ventilated into such chimney. The question of the ventilation of the gas cooker is usually one of finance, most consumers objecting to pay the cost of fitting efficient ventilating arrangements from the cooker. The question of the ventilation of gas cookers alone would be quite sufficient to take up the time of this meeting.

WASH-BOILERS.

The practice with regard to the fixing of flue pipes to gas-heated wash-boilers appears to vary considerably with different undertakings. In Birmingham we consider that a flue pipe is essential. As in most cases a brick flue is not available, a 3-in. asbestos cement pipe is taken vertically off the flue nozzle of the boiler as high as possible inside the house, and then outside to a cowl termination.

This question of flues to wash-boilers is one on which I know there is no unanimity even in our own Midlands district, and if we cannot agree among ourselves, how can we ask for any pronouncement of National policy? Yet we should be able to go to the architect with a definite recommendation, and I feel that this is a subject which would well repay a special discussion by your Association with a view to the establishment of a common policy. Personally, I advocate a flue, because I know that these wash-boilers are often fixed in very small rooms, almost devoid of ventilation; the products, if not carried away, escape just at breathing level, and the housewife who will inhale them is often already fatigued, for clothes washing is one of the hardest jobs in the house. Any fault in the construction of the boiler or in the amount of gas passing to the boiler may lead to the formation of carbon monoxide, and I am definitely of opinion that the flueless wash-boiler represents a risk the industry cannot afford to take.

TROUBLE DUE TO FAULTY CONSTRUCTION.

It is obvious that if we are to take special care to remove the products of combustion from rooms in which appliances are fixed, we should first make certain that the construction of appliances is such as to enable the products to leave the apparatus at the designed outlet. In some wash-boilers considerable trouble, and even danger, is caused by insufficient area being provided for the passage of the products of combustion through the flue nozzle of the boiler. On the boilers supplied by the Department we have fixed a special cast nozzle having a

larger area for the products than is usually provided, and being constructed to take the 3-in. asbestos cement flue pipe.

Many of the cheap boilers supplied by various merchants to the builders have insufficient space between the inner pan and outer case to enable proper combustion of the gas to take place even when the high consumption is reduced considerably. We do not hesitate to condemn such apparatus, which in our opinion is unsafe.

Geysers.

I have not spoken of the ventilation of geysers, as this has been dealt with in the booklet entitled "Instructions for Fixing Geysers" published this year and compiled under the authority of the National Gas Council. This pamphlet is a revision of the one published in 1924, and, in view of Recommendation No. 6 of the Gas Poisoning Committee, a careful study of this booklet is very desirable. The recommendation reads "that geysers shall be properly fixed and adjusted, and that both the apparatus and the room in which the apparatus is fixed shall be adequately and efficiently ventilated. It should be made unlawful to instal or maintain a geyser without a proper flue." The revised booklet should, in my opinion, be circulated by all gas undertakings, to architects, builders, plumbers, and ironmongers, in addition, of course, to each gasfitter in the employ of a gas undertaking.

CITY OF BIRMINGHAM.

Extract from Building By-Laws Relating to Ventilation of Habitable Rooms.

Clause 73.

Every person who shall erect a new domestic building shall:

(1) Cause every habitable room of the building which is without a fireplace, and a flue properly constructed and properly connected with the fireplace, to be provided with special and adequate means of ventilation by a sufficient aperture or air shaft which shall provide an unobstructed sectional area of one hundred square inches at the least.

(2) In a habitable room in which a fireplace and flue are constructed for use in connection with a gas fire or other similar means of heating apparatus only, cause special and adequate means of additional ventilation to be provided by a sufficient aperture or air shaft having an unobstructed sectional area of fifty square inches at the least.

Clause 74.

Every person who shall erect a new domestic building and shall, for the purpose of heating any habitable room therein, provide a gas fire or other similar apparatus shall, for the purpose of securing the ventilation of such room, construct an adequate flue in connection with such gas fire or apparatus to discharge above the roof by means of a chimney or other suitable outlet.

Discussion.

Mr. W. G. S. Cranmer (Willenhall) remarked that there was no necessity for Mr. Rogers to apologize for the scrappy nature of his notes. They were extremely interesting, and there must be very few of them who had not come up against difficulties which these notes had elucidated. Cases were often met with in which a coal fire chimney refused to function, and the householder decided to put in a gas fire, thinking that the latter would operate efficiently although the former did not. Of course, frequently it was quite a mistake to think that the products of combustion from a gas fire would ascend where those from a coal fire would not. Some thirty years ago he realized that a satisfactory coal fire flue was not necessarily suitable for a gas fire, and in some offices he built at that time he provided 4½ in. square flues, which had answered the purpose admirably. There had been very little in the way of mortar dropping to the bottom of the flue. About ten years later he had more work to do on his own premises, and he thought he could improve upon the 4½ in. square flue by putting in 4 in. glazed drain pipes. He found these quite satisfactory for gas fire flues; but to one of them he connected-up the outlet of a circulator, and then trouble commenced. Damp patches began to appear on the walls, and it was not until considerable damage had been done that he discovered it was through condensation from the water heater. He had put these pipes with the spigot leading upwards into the sockets. The result was that condensation took place in the pipe, and travelled down outside the spigots into the brick work. He replaced this by a cement asbestos vent pipe carried up to the eaves, but the result had not been entirely satisfactory. He had been recommended to put in a very much larger pipe with an open bottom, so that there would be a considerable amount of air mixed with the products, which would result in less likelihood of condensation. Some little time back he had a combined fire and mantelpiece submitted, and the space underneath the bottom of the fire was left open. If the space behind the grate was left open, there was a danger of the pull of the flue upsetting the combustion at the burner; and he recommended the makers to put a movable plate underneath the fire, which could be removed so that any accumulation of droppings from the flue might be raked out, and when the fire was in use there would be no possiblity of air being pulled in. Mr. Rogers had mentioned ventilation of gas cookers, which was frequently an extremely difficult problem. It was generally only possible to put such flues through the wall, and then one was troubled with back draught when the wind happened to be blowing against that wall.

Suggested Committee to Draw Up Rules.

One point which might be considered was the accommodation for cookers and wash boilers in kitchens. In many of the small houses being built at the present time, the kitchen was cut down to the lowest possible limit. The last thing the architect and builder thought about was the gas cooker, for which absolutely no provision was made. They might very well form a Committee to draw up rules which could be submitted to the various authorities, and distributed among architects and builders throughout their area. This would perhaps give them some guidance as to what they ought to do in cases of this kind. There was practically no house built now-a-days in which a cooker was not required by the tenant.

Mr. Harold Davies (Chesterfield) said the question of ventilation of all gas apparatus was one of the greatest importance, and it was necessary in the first place they should make sure that satisfactory flues were built. He recalled one instance in which the architect was persuaded to put in a special flue pipe for the ventilation of the cooker in very small kitchens. The cookers were placed immediately beneath the flues so provided, and after they had been in use for some time the undertaking received instructions to remove many of them, because droppings of mortar occurred. If one was going to provide such flues, it was necessary to have special maintenance, because the only means of telling whether they were in good working order was by the products of combustion. Without means of ascertaining whether or not the flue was in perfect condition, one was not going to get satisfactory results. It was essential that they should observe how coppers were constructed, because if the design was not perfect they might have the flames smothering. With all coppers he bought he was exceptionally careful to have a test, to satisfy himself that there was ample outlet for all products of combustion.

A Central Laboratory?

Mr. F. C. Briggs (Dudley), who proposed a vote of thanks to Mr. Rogers, said this was a pet subject of his own, and he considered it was one of the utmost importance to the gas industry generally. It was a matter of which engineers knew least, because it was one to which they had given the smallest amount of attention. Mr. Rogers himself had said that there was no unanimity in the industry on the question of flues, and this was perfectly true. The troubles were not new ones. Flue problems, and particularly the one of condensation, had been with them for many years. It was a very urgent matter that they should at long last tackle the question of formulating some definite national scheme. One of the things Mr. Rogers had not had time to mention was the size of flues which they put to gas appliances, and this, of course, was a matter to which they must give the greatest care. The outlet nozzles of appliances also required watching. Gas fires to-day were mainly satisfactory, but many subsidiary appliances were far from being so in the case of quite a number of manufacturers. In his Presidental Address to the Association, it would be recalled that he had mentioned the question of a national testing laboratory to which they, as gas engineers, or the makers, could send an appliance and have it certified as hygienically sound, and get a report on its efficiency. This was a very crying need to-day; but he had found out afterwards that Mr. Rogers had forestalled him by many years by making the same suggestion in an address of his own. If every gas engineer had to test every appliance he bought, and every one was testing the same appliance, there was an enormous waste of time and energy. They should be able to get a definite report from some central authority which should be set up, and the body to do this was undoubtedly the Institution of Gas Engineers.

Mr. T. H. Poulson (Stafford), in seconding the vote of thanks, said that Mr. Rogers had been of great help to the Association on many occasions. His remarks that afternoon were no exception to the rule. The gas industry must proceed on more scientific lines with regard to ventilation problems in the future than it had done in the past.

Mr. Rogers remarked that he had put these notes together with the assistance of his staff, at a very busy period; but he had felt for a long time that this question was one that had not received the attention it should do from the average gas engineer, and he was therefore very anxious to bring it to the notice of the members. It might be that the many other duties of the engineer did not allow him to devote proper attention to this problem; but he did seriously suggest to every administrator of a gas undertaking that he should see that the members of his staff responsible for fitting apparatus received the utmost possible help in the matter of ventilating appliances. The Gas Light and Coke Company, at Watson House, and other gas undertakings over the country, had for some years past been devoting much attention to the ventilation question; but the information they accumulated was not disseminated throughout the industry, though they owed that Company great thanks for the assistance they did render to the industry generally. Mr. Masterman's paper was practically the first effort to get down to the real scientific basis of ventilation. Great improvement could be effected by gas undertakings getting the men who were actually doing this work to give the utmost care and consideration to the job. It was impossible to lay down any hard and fast rule with regard to ventilation. Every job, one might almost say, differed from others, and it required experienced men to deal with the work. The best schoolmaster, of course, was experience. Mr. Cranmer had referred to the satisfactory functioning of 4½ in. by 4½ in. flues. Of course, all the factors must be taken into account, and it was necessary to know exactly the consumption of gas requiring to be dealt with, and also the particular position of the outlet of the chimney. One of the difficulties that research workers experienced was that of arriving at a satisfactory basis for specifying anything like standard tests. With regard to the effects of condensation, this was a matter in connection with which every gas undertaking had

had trouble. As he had mentioned in his opening, the only way in which to deal with the problem of a small volume of products was to get rid of them as quickly as possible, or, as an alternative, to construct the flues of glazed earthenware and make arrangements for the collection of the condensation at the base. It was a problem with which they would be faced more than ever in the future, because of the increased efficiency they were getting, particularly with water heating appliances, where the temperature of the products was very much lower than was the case some years ago. Mr. Cranmer had referred to a combined fire and mantelpiece having an arrangement whereby a plate might be removed to withdraw the droppings of mortar. With a gas fire and mantelpiece one ought to insist upon a back casting to reach right down to the bottom of the hearth, without any holes whatever, so that the only outlet for the products would be via the designed flue outlet above the radiants.

THE WOMAN'S WORKSHOP.

He advocated very strongly that the scullery should be a much larger apartment. The scullery, with the various gas appliances, was the woman's workshop; and the architect should be induced to make it bigger, even if he had to make the so-called kitchen still smaller. If they took every opportunity when meeting architects of telling this story, they would be backed up by the people who were going to live in the houses. They would then have plenty of room for their apparatus. It was far better definitely to refuse to fix apparatus than to take what they might regard as an unjustifiable risk. The advisability of a national testing laboratory had been talked about for the last twenty years, and he thought they were getting very near to the time when something would be done in the way of co-ordinating the various tests made by those undertakings who had facilities for so doing. Whether it would be better to co-ordinate existing laboratories or to set up an entirely independent testing laboratory was a matter which would have to receive careful consideration. The time had, however, arrived when they had talked enough; and if the Association felt they could take steps which would enable the subject to be re-opened on fully representative lines by a Committee, then something might result from the meeting that afternoon.

Adaptation of Gas to Street Lighting.

By B. THORPE, Chief Chemist to the Huddersfield Corporation Gas Department.

[From a Paper before the Yorkshire Junior Gas Association, Feb. 22.]

The essentials to be aimed at in street lighting are the safety of property and the comfort and convenience of the wayfarer. We might add to this the attempts made to illuminate certain streets attractively, in order to persuade the wayfarer to frequent such streets. Thus we might say that street lighting ranges from personal security to commercialism.

Security is given by any illumination which will reveal surely and clearly the presence and the nature of a danger. Low illumination intensities have a tendency to produce silhouette effect—that is, a person or an article, of whatever colour it may be, will appear black—and certain street lighting can be classed as the silhouette type. For example, we see the motor car in black outline as it approaches, the background of the pavement, side walks, or walls being brighter. As the intensity of illumination increases from that needed for silhouette vision to that in which detail vision enters, there is passed an intermediate stage, in which the pedestrian is apt to lose sense of dependence upon the silhouette vision, and still may not be able to see detail clearly. Unless care is observed in this intermediate region, the danger to the pedestrian is enhanced. For example, a person on a fairly well lighted street may observe another person approaching in the distance, the stranger being seen in black relief. As he draws near, he may completely disappear by virtue of the fact that he has reached a point where his body is lighted to the same brightness as the background against which he is placed; in other words, he will be unnoticeable. A closer approach will cause him to reappear as a brighter object against a darker background. The actual hazard exists at the time of least visibility. This is a greater danger in the case of swift moving vehicles; and with certain types of lighting cyclists are very difficult to see and avoid.

Considerations of the foregoing make it evident that scientific investigations of street lighting are necessary. As in all types of lighting, reflection plays a very large part. The use of prismatic refractors, which can be classed as a recent improvement, is to my mind a step in the right direction.

Mention must be made of the following points which go to make up an efficient street gas lighting system:

(*a*) The gas mantle, its light emission and its durability.
(*b*) The type of burner, and the gas consumed.
(*c*) The type of lantern, its ability to withstand the action of the wind.
(*d*) Height of lamp column.
(*e*) The positioning of lamps, and their proximity to each other.
(*f*) Manual and non-manual control of street lighting.
(*g*) The value of photometric tests.
(*h*) The help given to street lighting by prismatic refractors and mantle arrangements.

SELECTION OF THE MANTLE.

Though two mantles of similar size may be identical in appearance, they may be entirely different in properties. One mantle may give a high initial illuminating power, but possess no wearing quality, this being due to light make and light impregnation; another may give low initial illuminating power, but possess lasting qualities. Thus the lasting qualities of a mantle are entirely dependent upon the material, mesh, and saturation.

It is apparent that, in making the selection, the mantle should undergo certain tests before a decision is arrived at.

As No. 1 and No. 2 mantles are chiefly used for street lighting, it is upon these that the following tests were applied:

1. *Ash Test.*—A rough test which was applied, and which gave interesting results, was the ash test. The mantle was placed upon a burner, and the gas lighted, and adjusted to give maximum efficiency. It was burned for one hour, and the ash was weighed.

2. *Inspection.*—In conjunction with the first test, an inspection test could be carried out. During the hour's test, the mantle was periodically inspected to detect any defect such as shrinkage, imperfect texture, &c.

3. *Shocking Test.*—This is the power of the mantle to withstand vibration, and action due to lighting. The mantles were burned for 48 hours before the shocking test was applied. The shocking machine used was that of the Woodall and Moon type. For the whole of the tests, the speed of the cams, which are driven by a small water wheel, was 130 r.p.m. The cams are geared to a train of wheels which indicate the number of revolutions, and incidentally the number of shocks. Observations were kept upon the mantle until it showed signs of breakage, when the apparatus was stopped and the index reading taken.

4. *Photometric Test.*—In this, the luminous output was obtained on the mean hemispherical basis.

The selection of the mantle was based upon the comparison of results obtained from tests applied to three different types of mantles of No. 2 size. The No. 1 mantle test was upon the type which gave the best results in the comparison test of No. 2 size.

From the results obtained, and taking into consideration the cost, I need hardly say that mantle A was chosen; and satisfactory results from an experimental standpoint are being amply borne out by the practical results obtained on the district.

NO. 1 SIZE (BIJOU).

The growth of motor traffic has warranted improved lighting of our main roads, and considerable attention has been paid to the development of the burner to meet the new conditions. The evolution of burners for street lamps can be classi-

TABLE I.

Make.	Type.	Burner.	Gas Consumption per Hour.	Gas Pressure. Tenths.	Calorific Value. Gross B.Th.U.	Ash Test. Grams.	Shocking Test.	Inspection Test.	Candle-Power.		Candles per C.Ft.
									Hor.	M.H C.P.	
A . . .	Loom-woven	Brays 790	3·71	36	502·0	0·666	Shocks. 2351	Result. Good	60·20	58·936	15·885
B . . .	Knitted	,,	3·30	36	499·8	0·560	2493	Good	58·20	56·474	17·113
C . . .	Artificial silk	,,	3·53	36	502·0	0·420	3125	Good	58·10	54·537	15·450

Table II.

Make.	Type.	Burner.	Gas Consumption per Hour.	Gas Pressure. Tenths.	Calorific Value. Gross B.Th.U.	Ash Test. Grams.	Shocking Test.	Inspection Test.	Candle-Power.		Candles per C.Ft.
									Hor.	M.H.C.P.	
A . . .	Loom-woven	Brays 795	1·31	36	496·8	0·400	Shocks. 2652	Result. Good	22·02	22·379	17·070

fied as follows: " C " burner (upright); inverted burner (universal), one mantle; superheater cluster burner (No. 1 or No. 2 mantles), cluster of mantles varying in number; superheater burner with nozzles in alignment (No. 1 or No. 2 mantles), mantles varying in number. The last-named type is a modern development which claims that the bulk of the light emitted is directed along the road and not on to the adjacent buildings. We are at present experimenting with this type of burner.

Table III. shows the types of burners we use in street lighting, at pressures varying from 43-tenths to 46-tenths water gauge.

Table III.

3-light	No. 1 mantle	consuming	5·3 c.ft. per hour
2-light	No. 2 ,,	,,	5·0 ,, ,,
3-light	No. 2 ,,	,,	7·5 ,, ,,
4-light	No. 1 ,,	,,	7·2 ,, ,,
4-light	No. 2 ,,	,,	10·2 ,, ,,
6-light	No. 1 ,,	,,	11·5 ,, ,,
6-light	No. 2 ,,	,,	15·0 ,, ,,
8-light	No. 2 ,,	,,	20·0 ,, ,,
9-light	No. 1 ,,	,,	18·3 ,, ,,
15-light	No. 2 ,,	,,	43·2 ,, ,,

Table IV. shows the renewals for nozzles of mantles for the year ended March 31, 1929.

Table IV.

No. of nozzles in use	12,908
,, ,, ,, (renewals)	2,341
,, ,, mantles used	27,422

This works out at approximately two mantles per nozzle. When it is considered that street lighting in Huddersfield covers the whole of the year with the exception of eight weeks from June 5 to July 31, I think you will agree that our renewal figure both for nozzles and for mantles is very low.

The Lantern.

The requirements of a good lantern may be classified as follows:

1. Wind and storm proof.
2. Durable.
3. An efficient chimney and cowl, so that all products of combustion shall be effectively carried away.
4. Contamination of products of combustion and inlet air must be avoided. This can be achieved by constructing the air inlet passage at a reasonably lower level than exit for the products of combustion. Also correct ratio of inlet air and gas volume to outlet volume of products of combustion.
5. All the metal work of the lantern to be made of copper, and thus prevent rusting.
6. The metal vertical stays should be as narrow as permissible, with due consideration of strength of the lantern, in order that light is not obstructed, thus avoiding shadows. The vertical stays should be strengthened with stiffening rods, which ensures that the lantern will be rigid.
7. The lantern should be of the puttyless type. The disadvantages of the putty type are: (*a*) The destructive effect on the lantern frame when reglazing; (*b*) time taken in reglazing; and (*c*) obstructed light due to putty on the glass at and near the stay.
8. The reflector should be efficient, and should be convex in form.

Uniformity of light must be aimed at in street lighting, and to this end the height of the lamp column and the distance apart have a definite relationship to each other. The height of the lamp (from light source to ground level) is determined by the candle-power of the burner employed, and must be placed at a sufficient height to avoid glare, which may have disastrous results. The maximum intensity of light of a lamp is approximately 20° to 30° below the horizontal, and therefore it would appear that a rule could be adopted for spacing of lamps, the rule being that the 20° to 30° light rays from successive lamps shall meet at the ground level.

Another rule based on experience, and which has been found to prove satisfactory is:

Distance from light source × 12 = half distance between lamps.

However, no hard-and-fast rule can be adhered to, because the erection of lamp columns is usually governed by local conditions, such as street corners, road widths, and volume of traffic.

The major portion of our lamp columns are 9 ft. high, the light source being 10 ft. 6 in. from ground level, and we are at present converting those on fairly busy streets to 12 ft. and 14 ft., the light source being 13 ft. 6 in. and 15 ft. 6 in. from ground level respectively. The lamps on the main shopping streets of Huddersfield have standards with two-way fitments, to which are attached 15-light medium " Rochester " lamps.

Manual and Non-Manual Control.

The control of street lighting is one which opens up a wide subject—too wide to enter at any length in this paper—and therefore I propose to make reference only to what is being done in Huddersfield.

The control of street lighting can be classified under three headings:

1. By means of by-pass.
2. By means of flash torches.
3. By means of automatic apparatus.

Ignoring No. 1, the claims of the latter two are of a controversial nature. Each have their pros and cons, and one type may have distinct advantages over the other owing to local conditions. About 90 p.ct. of our street lighting is hand-operated by Sugg steel flash torches, the remaining 10 p.ct. (outlying districts) being clockwork controlled.

Value of Photometric Tests.

Though my experience of street lighting is comparatively small, I am becoming more convinced than ever that it is necessary that we should study it from a scientific point of view. As stated previously, a good illumination of streets should be obtained, and though a visual examination will reveal differences in intensity of illumination, it is impossible to discern a difference of (say) 30-50 c.p. on a 350-c.p. lamp. This drop of 50 c.p. makes a great deal of difference when we come to test the illumination in foot-candles in the vicinity of the lamp—in other words the mean illuminating intensity. Therefore, I maintain that it is necessary to test our street lighting, and, in doing so, the adjustments made on the results obtained will help us to get a more efficient and regular street lighting system, and thus gain the confidence of our townsmen. Moreover, good illumination by our street lamps is a good advertisement for gas.

For the whole of the street lighting tests the Holophane Lumeter was used, with which it is possible to obtain readings in a range of 0-2000 foot-candles.

The British Standard Specification for street lighting states that lighting installations shall be grouped under eight classes, having a mean test point illumination of not less than the figures given for each class in the following table, together with the figures for the minimum height of the luminous centre of the light source above the ground.

Class.	Rates Mean Test Point Illumination.	Mean Height of Luminous Centre of Light Source Above the Ground.
A	2·0 ft.-candles and upwards	30 ft.
B	1·0 ,, ,, ,,	25 ,,
C	0·5 ,, ,, ,,	21 ,,
D	0·2 ,, ,, ,,	18 ,,
E	0·1 ,, ,, ,,	15 ,,
F	0·05 ,, ,, ,,	13 ,,
G	0·02 ,, ,, ,,	13 ,,
H	0·01 ,, ,, ,,	preferably 13 ,,

Class H installation is not recommended for streets which are likely to be used appreciably for through traffic. The mean test point illumination in the specification denotes the mean of the illumination at the test points in one class of installation.

Though class H is recommended for comparatively quiet streets, a census of lighting in busy streets of various towns would give some surprisingly low results, and some not more than the class H standard. The minimum test point illumination is the point at which the lowest illumination intensity is obtained in any one class of installation.

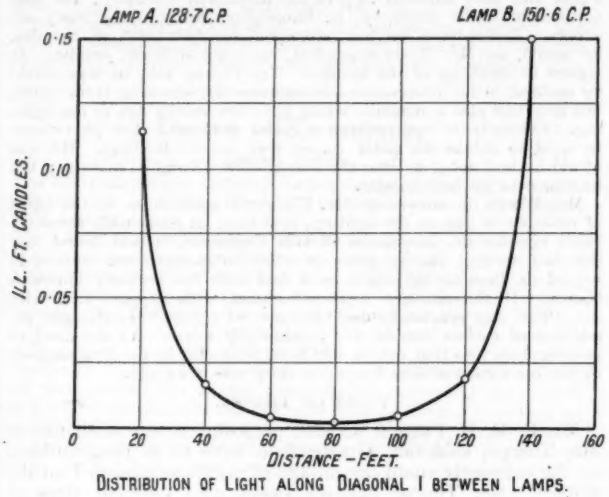
Results Obtained from Tests.

Tests were performed in street lighted by:

1. Three-light burner cluster, No. 1 size mantle.
2. Six-light ,, ,, No. 2 ,, ,,
3. Fifteen-light ,, ,, No. 2 ,, ,,
4. Six-light ,, with staggered nozzles, No. 2 size mantle (with and without prismatic refractor)

Most of our street lighting is on what is known as the staggered types. For the tests done on Nos. 1 and 4, the results were based on figures obtained along the diagonal between two lamps. For tests No. 2 (when three lamps were concerned, two on one side and one on the other side of the road) the results were based on the figures obtained in a rectangle of which the long side was formed by the two lamps; and for No. 3 the results were based on the figures obtained in the rectangle formed by two lamps on the diagonal.

Fig. 1 shows the distribution of illumination in a street which is very little used by through traffic. Three-light cluster burners are used, No. 1 size mantle. The light source was

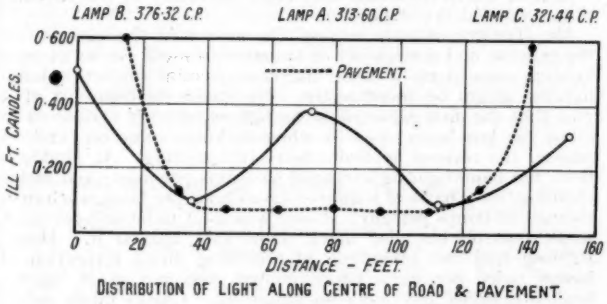


DISTRIBUTION OF LIGHT ALONG DIAGONAL I BETWEEN LAMPS.

Fig 1.

10 ft. 6 in. from ground level. The falling off of illumination intensity was very noticeable after 40 ft. from the lamp. The mean illumination was 0·0443 foot-candle, which puts this lighting in class G. The minimum test point illumination was 0·0025 foot-candle.

Fig. 2 shows the distribution of illumination in a street which is a 'bus and tram route; 6-light cluster burners were used with No. 2 size mantle, and the light source was 13 ft. 6 in. from

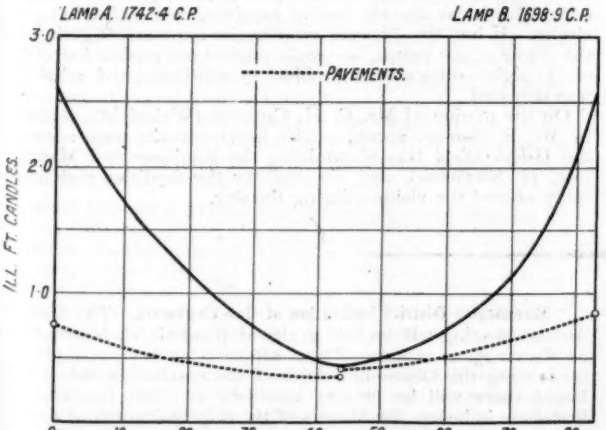


DISTRIBUTION OF LIGHT ALONG CENTRE OF ROAD & PAVEMENT.

Fig. 2.

ground level. The mean illumination was 0·203 foot-candle, which puts this lighting in class D. The minimum test point illumination was 0·065 foot-candle.

Fig. 3 shows the distribution of illumination in the main



DISTRIBUTION OF LIGHT ALONG CENTRE OF ROAD & PAVEMENTS.

Fig. 3.

streets. The mean illumination of 1·115 foot-candles puts this type of lighting in class B. The luminous centre to the ground level is 16 ft. The minimum test point illumination was 0·36 foot-candle.

PRISMATIC REFRACTORS.

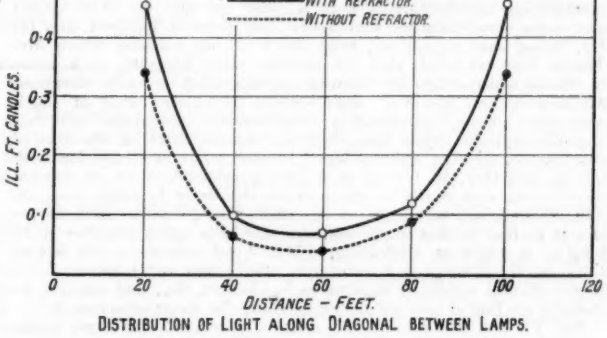
In the prismatic refractor the flutings or grooves have two plane faces inclined to each other, and therefore can be classed as prisms, through which light is refracted in various directions depending upon the angle of incidence. Then the rays from the light which strike the refractor at various angles will give a better distribution and complete diffusion of the light rays, resulting in the softening of the light and the removal of any glare and shadows. It was found that increased illumination resulted on the installation of prismatic refractors.

The refractor type of lighting was first used with success in interior lighting, by means of a specially prepared shade. These shades are made of clear glass and covered with flutings or grooves of carefully calculated curved prisms. This practical design has a twofold object:

(1) Complete diffusion with removal of glare.
(2) To distribute the light by deflecting rays and directing them where hitherto there would have been very little illumination. In the manufacture of globes and shades ground glass is employed to remove glare, which results in greater loss of light than with the prismatic refractor.

Before experimenting with refractors at Huddersfield, I was, through the courtesy of Mr. Robert Watson, of Doncaster, able to perform some tests on prismatic refractor lighting, which is in vogue at Doncaster. The tests were taken on a by-street, and gave a mean illumination of 0·0851 foot-candle. Unfortunately, I had no comparative results without refractors, but a test taken at Huddersfield with similar lighting without refractors gave only 0·0443 foot-candle.

Fig. 4 shows the distribution of illumination in a street which is a 'bus and tram route. Six-light staggered burners were used with No. 2 size mantles, at right-angles to the road, and the



DISTRIBUTION OF LIGHT ALONG DIAGONAL BETWEEN LAMPS.

Fig. 4.

light source was 13 ft. 6 in. from the ground. An increased mean illumination was obtained when refractors were installed, sufficient to raise the standard of lighting from class E to class D, without having to increase the consumption of gas per unit.

Discussion.

The PRESIDENT (Mr. F. Firth), opening the discussion, said he noticed that Mr. Thorpe had used decimals when quoting candle-power. He had to confess that on successive tests he (Mr. Firth) had made, his results had not agreed within a candle, and he ventured to suggest that the results given for the three different types of mantles were sufficiently close to be considered equal. In the latter part of the paper Mr. Thorpe had mentioned several times how he had raised the classification of certain installations from G to F, or (say) F to E, and appeared to regard this as a definite indication of improved lighting. Mr. Firth could not agree with such a view. After all, it was simply a matter of classification, and he did not agree that class F must necessarily be better than class G for the purposes of street lighting. The object of the classification was definitely stated in the Street Lighting Specification as being to classify different types of lighting installations. Mr. Firth said he noted that Mr. Thorpe spoke of the use of refractors rather enthusiastically as producing a marked improvement in street lighting. It was, however, a questionable point, because it did not follow that the flattest illumination was of necessity the best, and he certainly thought that flat illumination below a certain minimum was depressing and also not best from the visibility point of view. On the other hand, too much patchiness was equally undesirable. In deciding the type of lamp for any lighting installation, one had to take into consideration the duties it had to fulfil. Suburban street lighting, for example, as it existed to-day, was primarily intended to meet the needs of the pedestrian. Vehicular traffic at night was practically negligible, and such traffic as was present was usually travelling at low speeds. The lighting, therefore, besides giving reasonable visibility, should have

a cheerful effect and give a feeling of security to the user of the road, and it was upon the latter that public appreciation of lighting appeared to be based. For example, supposing a lighting installation having 2-light fittings were converted to 3-light fittings, there was no doubt that general opinion would be agreed that the lighting had been considerably improved; but, curiously enough, he (Mr. Firth) believed any member of that Association standing at ten yards distance from a lamp, with his back to the source of light, would find it extremely difficult, if not impossible, to distinguish between a 2-light and a 3-light fitting by visual observation of the ground illumination. This, he suggested, seemed to prove that what had appealed to the public in the example mentioned was the brighter source of light with its attendant cheerfulness.

Mr. C. H. CHESTER (Wakefield) observed that the author had not restricted himself to one type of mantle. One would like to know whether Mr. Thorpe considered a mantle with a fine mesh preferable to one with a coarse mesh—particularly the relative values from the points of view of radiation, intrinsic brilliance, and shock absorbence. The paper seemed to indicate that the author preferred a woven mantle. Mr. Chester said he would like to know whether Mr. Thorpe had done any work on the effect of nitrogen in gas on street lighting. In certain tests which he (Mr. Chester) had made, he had been very surprised at the very large drop in lighting value as the percentage of nitrogen increased, when the efficiency from the thermal point of view showed a very rapid decline. One would also like the author's opinion on the question of the advisability or otherwise of mantles set in tiers one above the other. This arrangement looked very effective in a street, but he rather thought the products of combustion for the lower mantles were likely to contaminate the secondary air for the combustion of the mantles above. In any such setting very great care had to be taken in the matter of maintenance. Mr. Thorpe had shown in his paper what a remarkable difference could be made by good supervision, especially as a standing public advertisement for gas as a street lighting medium. In regard to the matter of refractors, Mr. Chester said he noticed that at the British Industries Fair at Birmingham the stainless steel refractor was claimed to have some advantages.

Mr. J. W. WOOD, M.Sc. (Leeds University), said he did not wish to divert the discussion from the subject of street lighting in general, but he felt some useful reference might be made to the question of testing and to Mr. Thorpe's particular tests. The author had given certain figures for the gas consumption of his burners, using No. 1 and No. 2 mantles. If they took the consumption per nozzle in the cluster burners, they would find it was lower per mantle than the figures Mr. Thorpe had given in Table I. and Table II. The total illuminating power and efficiency of an incandescent burner depended considerably on the rate of heat supplied per mantle. The figures quoted for closer mantles were lower than given in Tables I. and II. Mr. Wood said he noticed, from the shocking machine which Mr. Thorpe had exhibited, that the mantles were subjected to a series of shocks which might be taken as corresponding to traffic vibration. Mantles in use, however, were subject to another kind of shock also—particularly if operated by clock controls or by-pass—and that was the explosion when being lighted, and the effect on the fibre of the repeated heating and cooling. Another point in connection with testing was that, in testing in a laboratory—and, after all, laboratory testing was nearly as good as on the street in many respects, and allowed measurements to be made perhaps more accurately—it was preferable that the photometer should be not more than 10 ft. long or it might be misleading. Mr. Wood said he would like to know if Mr. Thorpe had found any effects that could be attributed to the mutual screening of mantles in clusters, &c., and whether he thought the line of mantles should be along the street or across it.

Mr. THORPE, replying to Mr. Firth's question as to three places of decimals in candle-power, said he supposed this was by force of custom in the laboratory; but probably it gave him more accuracy than by going only to two points. The mantles he used on the tests were taken at random from stock. In regard to Mr. Firth's references to the standard specification for street lighting, Mr. Thorpe agreed that the classification was not necessarily meant to indicate merit, but for comparative purposes it was the only method one could use. In regard to refractors, perhaps Mr. Firth and he were not in entire agreement on the matter of their use; but, personally, he found it entirely removed the black spots in the road, to which they were so subject with gas lighting. After all, if refractors could be used effectively for electric lighting, why not for gas?

In reply to Mr. Chester, Mr. Thorpe said the mantles used were medium mesh, which they had made specially for their use at Huddersfield. He was sorry he could give no answer in regard to testing for radiation or intrinsic brilliance, but he hoped to do some such testing later. He had mentioned in regard to selection of the mantles that cost entered into the matter. In regard to the effect on lighting of nitrogen in the gas, he was sorry he had not done anything in that respect, and, therefore, could not give an answer. In reply to the question as to the placing of mantles in tiers, Mr. Thorpe said he had in mind a 9-light burner with 8 mantles in a tier and one in the centre; but, if one looked through a blue glass, the centre mantle was not illuminated, and obviously was not getting the necessary secondary air. In regard to the matter of stainless steel refractors, these, he said, were not stainless, but chromium surface, and that they were reflectors, and not refractors. Mr. Colquhoun, of Sheffield, had done some experiments with the chromium surface reflectors, and these were shown at the British Industries Fair at Birmingham. He certainly got reflection; but he (Mr. Thorpe) thought he also got reflection of heat as well as light, and the glasses were broken. Mr. Thorpe showed how the semi-circular chromium reflectors were fitted to lamps.

In answer to Mr. Wood, regarding the tests in Tables I. and II. and the consumption he gave with the burners used on the district, most of their burners had had the gas regulators removed and had a fixed nipple and were adjusted to give the maximum efficiency; the only adjustment to be made by the lamplighter being the primary air supply. Probably, if he had attempted another batch of mantles, he would, as Mr. Wood suggested, have got different results. In regard to shocking of the mantles, Mr. Thorpe said he was afraid he omitted in his observations to mention the shocking from flame, but they had also a machine which gave the shocks due to the lighting. Evidently he had omitted to point that out. The photometer he used to obtain the polar curves was not 10 ft. long. He was afraid he had not gone into the matter of screening of mantles; but he hoped to go into it later.

Mr. WOOD, in answer to Mr. Chester's question as to the effect of nitrogen in gas on the lighting, said that, in tests made some ten years ago for the Institution of Gas Engineers, it was found that this had nothing like so great an effect on incandescent burners in regard to illuminating power as it had with the ordinary luminous burner. If the nitrogen were introduced with oxygen—*i.e.*, with air—there was practically no difference whatever. He thought the addition of carbon dioxide was considerably worse. All the work of investigation into that matter had been published in the Transactions of the Institution of Gas Engineers some ten years ago.

VOTES OF THANKS.

Mr. E. R. B. FRENCH (Leeds), proposing a vote of thanks to Mr. Thorpe, said that Huddersfield were to be congratulated on the extremely small percentage of mantles consumed on the district. Mr. Thorpe had mentioned two different sizes of mantles. He wondered if it would not be better to make a standard of one or the other. An important point which could not be too much stressed was that of maintenance of lamps. The author had stated that in Huddersfield they had 10 p.ct. of the lamps under automatic control; and one wondered whether that small proportion of the total was not rather costly. In regard to the hand-lighted lamps, it would be interesting to know the number of lamps per man in the district. The chief point in public lighting was efficiency; and a vital point in this connection was proper maintenance and regular cleaning.

Mr. R. CROWTHER (Elland), Hon. Secretary of the Association, seconded the resolution.

Mr. THORPE, acknowledging the vote, said the question of the expense and desirability of automatic control *versus* manual lighting opened up a wide and controversial subject. Hand-lighting might be more costly. The main disadvantage of it was that the first lamp must be lighted at such a time as to allow the last lamp to be lit when darkness came on; and, of course, the reverse applied when extinguishing. At Huddersfield, the hand-lighting averaged 90 lamps per man; and as for cleaning, on a basis of a quarter-of-an-hour per lamp, each man cleaned 16 lamps per day. There was a lot to be said for automatic control, but also much to be said against it. Hand-lighting had the advantage of providing direct inspection of lamps twice per day. Clock control was not proof against broken mantles and by-passes going out. Clocks might refuse to function or might operate at the wrong time, and lamps might be lit during the day. Also, there was the cost of the consumption by the by-pass. Roughly speaking, they could say that a by-pass would consume 0·4 to 0·5 c.ft. of gas per hour. Assuming that Huddersfield went entirely on to clock control, with their number of lamps the total consumption per annum due to by-passes would be somewhere in the region of 20 million c.ft. There was also the cost of supplying and maintaining the clocks. If he (Mr. Thorpe) went in for automatic lighting for the whole of the lamps, he would require a complete inspection every night—otherwise the object of efficiency and reliability was defeated.

On the motion of Mr. C. H. CHESTER (Wakefield), seconded by Mr. E. BAILEY (Spenborough), hearty thanks were accorded the Huddersfield Gas Committee, the Engineer and Manager (Mr. H. Singleton), and his staff for the facilities and hospitality offered the visitors during the day.

Price Reduction at Bradford.—The Bradford Corporation Gas Committee recommend a reduction of charges for gas to local authorities outside the city to 3s. 2d. per 1000 c.ft., or 7·6d. per therm, as from April 1.

"Gas World" Analyses of Municipal Gas Accounts.—Messrs. Ernest Benn, Ltd., have published the 1928-29 Edition of this exceedingly useful work, at the price of 21s. net. The figures are set out in the usual clear style.

Manchester District Institution of Gas Engineers.—The Sixtieth Annual Meeting will be held at the Midland Hotel, Manchester, on March 25, at 11 a.m. There will be a luncheon at 1.30 p.m. celebrating the Diamond Jubilee of the Institution, when it is hoped there will be present members of the Government, leaders in industry, the Mayors of the principal towns of Lancashire, Cheshire, and the West Riding of Yorkshire, Members of Parliament for the District Constituencies, and leaders of the gas industry.

Parliamentary Intelligence.

[From Our Special Correspondents.]

House of Lords

Special Orders.

The following Special Orders, having been passed by the Special Orders Committee, have now been approved by the House: Exmouth, Coventry, Birkenhead, Chichester, and Bury. The following Special Orders have been laid before the House and referred to the Special Orders Committee: Haslemere and District Gas Company, Houghton-le-Spring District Gas Company, Wellington (Salop) Gas Company, and Stone Gas and Electricity Company, Ltd.

House of Commons.

Special Orders.

The following Special Orders have been presented and ordered to lie upon the Table of the House: Houghton-le-Spring, Wellington (Salop), and Stone.

Plans have been deposited in connection with the Tottenham and District Gas Order and the Plymouth and Stonehouse Gas Order.

The following Special Orders have been approved: City of Coventry, Exmouth Gas Company, County Borough of Birkenhead, City of Chichester Gas Company, and County Borough of Bury.

Private Bills.

The South Staffordshire Mond Gas Bill has passed its third reading.

All the petitions against the Brighton and Hove Gas Bill having now been withdrawn, the Bill has been referred to the Committee on Unopposed Bills.

A petition has been presented against the Glasgow Corporation Bill by the Coatbridge Gas Company.

Coal Mines Bill.

The amendment to Clause 3 of the Bill for the protection of gas, electric light, and water supply undertakings, originally put down by Mr. D. G. Somerville, M.P., has also been put down by the following Members: Mr. Louis Smith, Mr. Womersley, Mr. Granville-Gibson (Conservatives); Dr. Leslie Burgin, Mr. Ernest Brown, and Mr. Milner Gray (Liberals).

Holborn Explosions.

The Supplementary Estimate for £52,000 payable as compensation in connection with the Holborn explosion was introduced by Mr. VIANT, the Assistant Postmaster-General. He said that two hundred claims were being paid, that one hundred had been rejected, and that fifty were still on hand. The sum of £52,000 was an estimate of the maximum amount that would inure for payment during the current financial year.

Mr. A. M. SAMUEL asked what steps were being taken to prevent a repetition of this disaster.

Viscount ELMLEY asked what proportion the £52,000 bore to the total amount of damage done.

Mr. STUART BEVAN explained that an arrangement had been arrived at between the Post Office and the Gas Light and Coke Company, by which liability for the damage was admitted on the terms that the Post Office and the Gas Company would contribute in equal shares. He asked how much of the estimated sum of £52,000 had actually been paid to date.

The POSTMASTER-GENERAL (Mr. Lees Smith) said that they had taken a number of precautions, of too technical a character to be explained, for a ventilating shaft, and had made arrangements for pumping foul air out of the tube, while a number of appliances which the Chief Engineer had devised, for detecting any leakage of foul air, had been installed. Where these appliances could not be installed, the tubes were being filled up, so that precautions were being taken to make any such explosion exceedingly unlikely in future. The claims of third parties amounted roughly to £104,000. There were a hundred claims which were not met because it was held that the claimants had no legal grounds; but, of the claims which had been admitted, there were only fifty which had not yet been paid. The sum paid out was comparatively small, because some of those fifty were very large undertakings, whose claims amounted to several thousand pounds. Every possible expedition had been used in meeting the claims. The sum paid up to the moment was £18,000, which had met the larger number of the smaller claims, those of the tradesmen. The reason the sum outstanding was large was because the heavier claims had still to be dealt with, such as that of the Holborn Borough Council, which was over £40,000, the Charing Cross Electricity Supply Company, the Metropolitan Water Board, and other public authorities or public utility undertakings.

Blackpool Gas Department and Local Traders.—At the Annual Meeting of the Blackpool Chamber of Trade, on Feb. 21, it was reported by the executive that they had strenuously opposed the proposal of the municipal Gas Department to establish what was practically a monopoly in the sale of gas appliances. An amicable settlement had been reached, and the whole of the business which would accrue from the Department's introduction of the hire-purchase system would now be enjoyed by local tradesmen.

New Scale of Charges at Blackburn.—The Blackburn Gas Committee have adopted a new scale for large consumers as follows: Present charges: Up to 100,000 c.ft. per quarter, 3s. 6d.; 100,000 c.ft. to 500,000 c.ft., 3s. 2d.; 500,000 c.ft. to 1 million c.ft., 2s. 11d.; 1 million and over, 2s 8d. New charges: Up to 30,000 c.ft. per quarter, 3s. 6d.; 30,000 c.ft. to 250,000 c.ft., 3s. 3d.; 250,000 c.ft. to 500,000 c.ft., 3s.; 500,000 c.ft. to 750,000 c.ft., 2s. 8d.; 750,000 c.ft. to 1 million c.ft., 2s. 4d.; 1 million c.ft., and over, 2s.

Fuel Research in South Africa.—A Bill to constitute a corporate body, to be called the Fuel Research Institute of South Africa, now before Parliament, states that the objects of the Institute, *inter alia*, are to study and investigate the fuel resources of the Union, and to undertake scientific technical research in all matters connected with fuels in general and with fuel bye-products, and to grade coals for export or bunkering. The head office of the Institute is to be established in Pretoria. The Governor-General is empowered to appoint a Fuel Research Board consisting of five members. The duties of the Board will be to formulate and control the policy of the Institute on broad national lines and act in an advisory capacity to the Minister in all matters relating to the Institute.

Patents Committee, 1929.—The Committee which was set up under the Chairmanship of the Right Hon. Sir Charles Sargant to consider whether any amendments in the Patents and Designs Acts, or any changes in Patent Office practice, are desirable, is continuing its weekly meetings at the Board of Trade, for the purpose of hearing evidence from interested persons and associations. Twenty meetings of the Committee have taken place, and during the next few weeks evidence will be taken from representatives of the Chartered Institute of Patent Agents, the Law Society, and several Chambers of Commerce. Any persons or associations who desire to submit any further suggestions, or to give evidence, should notify their intention to the Secretary to the Committee, Mr. R. W. Luce, Industrial Property Department, Board of Trade, 25, Southampton Buildings, W.C. 2, not later than May 1 next.

Sulphate Storage at Billingham.—One of the latest pieces of construction at the Billingham works of Synthetic Ammonia and Nitrates, Ltd., is a silo capable of storing one hundred thousand tons of sulphate of ammonia.

The Year's Results at Burton.—The report on the position of the gas undertaking came before the Burton-on-Trent Town Council on a recent date. It showed that during the year ended March 31 last there was a deficit of £12,334, as against a surplus on the previous year of £2349. Income was down by £7348, and expenditure up by £5674. Though gas sales increased by 2 p.ct. in quantity, the total value showed a decrease of £2058, and residual products a decrease of £5177. The Mayor (Councillor W. H. Giles), who introduced the report, explained that during the past 10 years upwards of £53,000 in addition to £12,724 in suspense account had been expended on meters, stoves, and fires, and the total received for rentals was only £4863, so that the policy of not charging rentals in most cases had been equivalent to a lower price being charged for gas. The report was adopted.

Competition with Private Traders at Barnoldswick.—A lively discussion on the extent to which sales of appliances should be made from gas or electricity showrooms of local authorities, in competition with local traders, took place at the Barnoldswick Urban District Council meeting for March, when a deputation was received from the Chamber of Trade, opposing any sales from the new electricity showrooms in Church Street, or the wiring of houses by the Council. The case of the Gas Department showrooms was quoted by the Council as showing how such showrooms—even if they do some actual selling—are good for the public and for all concerned in the particular industry. Mr. G. S. Vaughan, a member of the Council, suggested that private traders did not suffer from the effects of municipal trading in household appliances to the extent they claimed. Over 3000 gas cookers and boilers had been sold as result of the opening of the local gas showrooms, and he questioned whether anything like that number would have been installed in the people's homes had they not been supplied by the Council. Mr. Merrall, a plumber, said the traders had no complaints to make in regard to competition by the Gas Department. In fact, they met fairer treatment in Barnoldswick than in some other towns of which he had had experience. The Electrical Engineer pointed out that if the Council undertook assisted wiring the local contractors would benefit by extra business in fittings, &c. The deputation thanked the Council for their reception, and expressed themselves satisfied with the assurances given as to amount of trading likely to be done.

Gas Companies' Results in 1929.

Continued Prosperity Throughout the Country.

BRIGHTON.

The Annual General Meeting of the Brighton and Hove General Gas Company was held at the Offices, 5, Great Winchester Street, E.C., on Friday, March 7—Mr. A. M. Paddon (Chairman) presiding. In moving the adoption of the report and accounts (extracts from which have already appeared in these columns), the Chairman said: During the year we have reduced the price of gas from 9·6d. per therm to 9d. per therm. This represents a reduction of 0·6d. per therm, which is equal to 3d. per 1000 c.ft. That, reduced into figures, means that the consumers this year will be charged something like £30,000 less in the current year compared with the beginning of last year, but as this reduction was made in two separate amounts, the total saving to the customer during the period under review is about £17,000, which is a not unimportant amount Going to the revenue account, on the credit side it will be seen, by comparison, that our total rental exceeds that of a year ago by a sum of £1577, which, taking into account the reduction of price that I have mentioned, may be regarded as wholly satisfactory. When we come to residual products, these constitute the most sensitive point in gas accounts at this particular juncture, as very often there are disturbing factors in connection with residuals. To epitomize them, while coke has realized £8268 more, tar has realized £8324 less. Setting these accounts against those of a year ago, there is only a total difference of £56, which, having regard to the recorded results of other gas undertakings, is extremely satisfactory. The difference between the total receipts for the year 1929 and the preceding year is very small. We have received £1423 more. In regard to the sales of gas, which I have hitherto referred to in percentages and therms, we have increased our business during the year by over 100 million c.ft. On the debit side of the account, by reason of the increase in the sale of gas alone, there is an advance in the total cost of coal, oil, and coke of nearly £4000. Our repairs, maintenance, and renewal of works and plant have cost £12,000 more, and that amount is thoroughly well represented in the improvement of our apparatus and the greater efficiency acquired by that expenditure. With regard to the rest of the accounts, it is singular how closely they conform to those of a year ago. So much so that there is really no particular item to which I need draw your attention except perhaps that relating to the repair and maintenance of stoves and fittings, on which we have spent some £3600 less. That figure represents even now a little over 6d. per 1000, which is an ample provision for this apparatus, and we have reduced by depreciation the older forms of apparatus coming under this heading, and by charging a more appropriate proportion of this expenditure to revenue than in previous years, we keep it under closer control. Our total expenditure is £11,787 more, and our profit £10,364 less. In the profit and loss account there is nothing particular which calls for comment. There is a small charge on the debit side of £383 for promoting a special Act. On the other side, you will see we brought into this account £77,417, and we take out of it £79,075, so we have improved our position by something over £1600. With regard to the reserve fund, you will see there is a recorded transfer from the profit and loss account of £2534, bringing the total amount to some £92,600, which is wholly invested in Government and Trustee securities. The special purposes fund benefits by a transfer from the revenue account of £8000, increasing it to £54,601, of which £43,000 is invested. The renewal fund has been supplemented by £3600 from the revenue account, but, being something in the way of a floating balance for the requirements of the works, its dimensions are not so important as those preceding it. The capital redemption fund is an anachronism, as its dimensions will show. The benefit fund shows that we have transferred from the revenue account just under £5000, and we have distributed during the year £5520. Turning to the balance-sheet, there is not a great deal there to which I need refer. I spoke to you about the decrease in the floating balance in respect of stoves on hire, and you will see this balance standing at £51,598, which is a decrease of over £5000 from what it was a year ago; this is an eminently satisfactory advance in the right direction. With regard to the investments, they are shown at their book values of £154,231, and their value on Dec. 31 last was over £164,000. That again is a satisfactory relation between the book value and the actual asset.

COLCHESTER.

The Annual Meeting of the Colchester Gas Company was held at the Company's Offices, 29, High Street, Colchester, on Feb. 28—Mr. W. Gurney Benham (Chairman) presiding. The report of the Directors for the year ended Dec. 31, 1929, stated that the sales of gas increased by over 2 million c.ft., and the business of the Company continued to expand, a large number of appliances having been fixed during the year. The balance on the revenue account for the year amounted to £12,252, a reduction of nearly £2000 compared with the previous year,. which was entirely attributable to the de-

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crease in the value of residual products, principally tar. In view of this reduction in the receipts the price of gas had been increased as from the Christmas reading of the meters by 3/5ths of one penny per therm. The Directors had realized for some time that the gas holder capacity at the works was gradually becoming inadequate for the continually increasing output of gas. The last addition to the gasholder storage was made as far back as the year 1898, when the output of gas amounted to 115 million c.ft., as compared with 291 millions in 1929. It had been decided, however, to postpone the work as long as possible in view of the large capital expenditure entailed. The Chairman, in moving the adoption of the report, said that with regard to the falling off in the value of residual products, due mainly to the slump in the price of tar, caused by severe competition, the receipts from this source during 1929 were £14,716, against £17,685 in 1928, a falling off of nearly £3000. As compared with 1927, the falling off was £4500. The coal bill for 1929 had been £28,049, against £28,463 in 1928. More coal had been used, but the price had been a little more favourable. Though in the past year approximately 50 p.ct. of the coal bill had been recouped by the sale of residuals, the falling off to the extent of nearly £3000 had materially affected the finances of the Company. In order to make up for this decreased revenue it had been necessary to make a slight increase in the price of gas. The increase had been so slight that it did not affect the legal right of the Company, under the sliding scale, to declare dividends larger than had been paid and larger than were now recommended. As stated in the report, the Directors had decided to instal a new gasholder of a capacity of 750,000 c.ft., and they had been able to purchase this at a very favourable price. This addition would bring the storage capacity to somewhat more than 1½ million c.ft., or slightly in excess of the maximum amount of gas delivered last year in 24 hours. This amount was generally accepted as the correct figure, but for many years the Company had been working with only about half-a-day's storage, and the new gasholder would give added security to the supply.

EAST SURREY.

The Ordinary General Meeting of the East Surrey Gas Company was held on Feb. 27 at the Club Room, Gas-Works, Brighton Road, Redhill—Mr. W. Lees Stenning, J.P. (Chairman), presiding. The Chairman, in moving the adoption of the report and accounts (extracts from which have already appeared in the "JOURNAL"), said that the sale of gas showed the satisfactory increase of 104,740 therms, equal to 5·2 p.ct. The greater part of this increase occurred during the record cold spell in the early months of the year. In addition to the final capital expenditure on the amalgamation, the sum of £9030 had been spent on new plant and buildings, £13,424 on additional mains (a portion of this being for the linking-up of the Dorking works with their Redhill System), and £1503 on new meters and stoves. Against that £18,205 of 5 p.ct. irredeemable debentures were issued during the year. They were constantly improving and modernizing their plant, and with the growth of the district, it was essential that they should look ahead, so that they might maintain a good supply to every consumer. Their co-partnership scheme continued to work well, and the cost last year was £1633—a sum which he was sure no stockholder would grudge—and he would like to testify to the good work of the whole of their staff. The amalgamation with the Dorking Company took place late in 1928, and though the adjustment of stockholdings and three months' revenue from the Dorking area were shown in that year's accounts, there were still several matters which it was not possible to deal with then which were shown in this year's balance-sheet. The Dorking branch was yielding its full quota of new business, and they had pleasing evidence that the reduced price in that district and the increased facilities which their larger undertaking was able to offer were much appreciated by consumers there.

EASTBOURNE.

The Directors of the Eastbourne Gas Company submit the following accounts for the year ended Dec. 31, 1929. After payment of an interim half-yearly dividend in September last, and providing for the payment of interest and all standing charges, there is a balance of £21,011 at the credit of the profit and loss account. The Directors recommend the payment of the full statutory dividends for the second half of the year—viz., at the rate of £5 p.ct. per annum upon the £3150 5 p.ct. preference stock; £8 10s. p.ct. per annum upon the £65,000 "A" stock; and £7 p.ct. per annum upon the £198,000 "B" stock. These dividends will absorb the sum of £9771, leaving a balance of £11,240 to carry forward. The sales of gas show an increase of over 26 million c.ft. for the year, equal to 4·17 p.ct. Premises adjoining the present showrooms have been acquired for the extension of the Company's premises.

EXETER.

A satisfactory year's work was recorded at the Annual Meeting of the Exeter Gaslight and Coke Company held on Feb. 25, under the Chairmanship of Mr. John E. Daw, at the Offices of the Company. In moving the adoption of the report and accounts (which have already been published in the "JOURNAL"), the Chairman said that the weather was a great factor in "gas" life, and, though the severity of the spring of 1929 had been somewhat tempered by a mild winter, the increase in the sale of gas had been remarkable, being no less than 221,189 therms, or over 45 million c.ft. This was the largest of a series of annual increases during the past 10 years. Taking the years 1919 and 1929, the annual sale in the latter year exceeded that of 1919 by 257 million c.ft., which showed an increase of 54 p.ct. in 10 years. The Directors had placed an order for a new holder to contain 2 million c.ft., and the foundations for this were well under way. A number of mains had been renewed during the past year where pipes had become somewhat defective, with the result that an improved supply of gas had been available at various points in the distributing system which better met the needs of customers in the vicinity. One of the results of keeping the distributing

mains in thoroughly good condition had been that the gas unaccounted-for in 1929 reached the remarkably low figure of just under 2½ p.ct. of the total make. The Directors had decided to extend the supply of gas to the Broadclyst district. At an extraordinary meeting of the Company the question of a profit sharing scheme was discussed. The Chairman said the Exeter Gas Order, 1927, gave the Directors power to put into operation a profit-sharing scheme for the employees of the Company, subject to the sanction of the shareholders at an extra-ordinary general meeting. In recommending this course the Directors were following the practice of numerous other gas undertakings which had found the system successful in securing the fullest possible support of the employees in efficiently carrying on and extending the business of their respective concerns. The scheme the Board had provisionally drawn up provided for a profit share depending on the price of gas. At the present standard rate of 8d. per therm, the percentage would be 3 p.ct. on the salary or wages exclusive of any bonus, overtime, or other allowances. This percentage would vary up or down as the price of gas varied. The Directors intended to call a meeting of the Company to consider a pension scheme for employees to be linked up with the profit-sharing proposals. At present the Company was paying £1000 a year to old employees. He moved that a profit-sharing scheme be put in operation.

IPSWICH.

In spite of a decrease in the price of gas in the early part of last year, the Ipswich Gas Company were able to show increased profits at their Annual General Meeting—the Chairman, Mr. Henry Woodall, presiding. The annual report of the Directors and the accounts having been taken as read, the Chairman said that in April last they reduced the price of gas, and while the cost of coal, wages, and nearly all materials had risen enormously on pre-war figures, their price of gas was only 44 p.ct. above that of 1913, a fact which went far to prove the efficiency of the undertaking. It was satisfactory to record that during the year they had added 865 new consumers, by a curious coincidence exactly the same increase as for 1928. In order to cope with the extraordinarily heavy demand for gas during the cooking hours they had renewed a large number of mains, and it might interest them to know that on one occasion, in one hour, from 12 to 1 o'clock, they sent out no less than 370,000 c.ft., equivalent to a daily output of nearly nine million. This was on a cold day in February last year, and showed to what extent the public depended upon gas for cooking and heating. The chief events of the year had been the completion of the trunk main to Woodbridge, which town was now directly supplied from Ipswich, and the taking over of the Felixstowe undertaking. They had had to spend a considerable sum at Woodbridge in putting the distribution system in order, and though that was not yet completed, the supply of gas had been much improved. Late in the year they opened a new showroom and office in the Thoroughfare. The number of consumers in Felixstowe and the district was now 3185, an increase of 172 upon 1928. During the year they had redeemed £1250 of the 5 p.ct. redeemable stock, which was rather less than in the previous year, and left a balance of £9000 to be redeemed during the next three years. Rates and taxes were up, chiefly by reason of taxation on increased profits, whilst their rating assessment had been increased. A little larger amount had been transferred to the credit of the special purposes fund, which now stood at over £20,000; the renewal fund had received a contribution of £1500 and now amounted to £9187; the reserve fund amounted to £23,115, so that they had a total reserve of £52,625. On the receipts side, though they reduced the price of gas last April, there was a gratifying increase of £2000. They had done well with coke, which showed an increase of £1900. They specialized in supplying coke for domestic purposes and for central heating stoves and made a feature of selling coke in 1s. bags, last year delivering no less than 20,112 of these bags. Breeze, tar, and sulphate of ammonia all showed slight decreases. Their total revenue was £169,595, being £3000 higher than last year, while their working expenses were £149,472, leaving a balance to be carried to profit and loss of £20,123. Dividends were agreed to as follows: At the rate of £6 7s. 6d. on the consolidated stock, making a dividend for the year of £6 6s. 10d.; at the rate of 5 p.ct. on the redeemable stock; 5 p.ct. on the 5 p.ct. preference stock; and 7 p.ct. on the 7 p.ct. redeemable preference stock.

OXFORD.

The Annual General Meeting of the Oxford Gaslight and Coke Company took place in the Board Room, "York House," St. Aldates, Oxford, on Saturday, March 1, when Alderman F. W. Ansell, J.P., the Chairman of the Company, presided. The Chairman, in moving the adoption of the report, said: Turning to the revenue account, it will be noticed that our expenditure on the manufacture of gas is increased by approximately £5000; and on the distribution of gas a decrease of approximately £1000 is recorded, and that for the first time a co-partnership bonus of £1542 appears in our accounts. The total increased expenditure amounts to £7750, or 4¾ p.ct. On the other side of the accounts we have sold approximately 5¼ p.ct. more gas, our revenue from gas, and meter and stove rents having increased by £6523; but residuals show a decrease of approximately £800, due entirely to the receipts for tar and liquor, which show a decrease of £3561, or over 42 p.ct. The net result is a profit of £41,704, which I feel sure you will consider highly satisfactory. Dr. Druce, in seconding, stated they would notice that the report was a good one, though the profit was not quite so large as last year by £2000. The Chairman then moved the payment of the full statutory dividend at the rate of 5 p.ct. per annum on the preference stock and a dividend at the rate of 10 p.ct. per annum on the ordinary stock for the half-year ended Dec. 31, 1929. Mr. W. E. Caton (Engineer and Manager) then gave a few details of the working results which do not appear in the balance-sheet. The make of gas per ton of coal, he said, had been well maintained. During the year the number of new consumers had increased by 1235, or 7 p.ct., as compared with 823 for the previous 12 months. The number of additional cookers on hire and sold outright had increased by 1242, as compared with 927 in 1928. The number of gas fires on hire and sold outright had increased by 770, as compared with 897 for the previous 12 months. The number of radiators, geysers, and circulators in use had increased by 168, as compared with 222 in 1928. The number of slot installations fitted up had increased by 569, as compared with 200 in 1928. From these figures they would observe the increased use of gas for all purposes continued good. The number of public lamps had increased by 104, as compared with an increase of 27 the previous year, and the candle-power of 385 lamps had been increased from 125 to 240. The quantity of gas sold last year exceeded that of 1928 by 42¼ million c.ft., or 5·15 p.ct.

SCARBOROUGH.

Greatly improved street lighting, to make the town even more attractive than it is at present, was foreshadowed at the Annual Meeting of the Scarborough Gas Company, held on Feb. 22. The Company have declared a dividend of 5 p.ct. on preference shares and of 5⅝ p.ct. on the ordinary stocks, against 5 p.ct. last year. In moving the adoption of the report and accounts the Chairman (Mr. W. S. Rowntree) said that the sale of gas for the year reached 635 million c.ft.—an increase of 2·6 p.ct. over the previous year. The quantity of gas sold had doubled since he was appointed Chairman in 1910, when the number of consumers was 10,869, as compared with 14,414 to-day. During the year expansion of the Company's business had made it necessary to lay additional mains and purchase further meters and stoves, to the amount of nearly £9000. There had been fixed 500 cookers, 924 fires, 433 washing coppers, and other appliances. The general prosperity of the Company had not only justified the reduction made last year from the basic price of gas, but had enabled them in consequence of the reduction to increase the dividend by seven-eighths. The present position and outlook of the undertaking justified them in making a considerable concession to the town in the matter of public lighting. It had been stated that Scarborough's street lighting was second only to that of London, but they wanted to do better still, and had submitted to the Corporation a scheme by which, at no extra cost to the ratepayers, the brilliant lighting now confined to the sea front and Westborough would be extended to all the principal streets of the town. The lighting of other streets would be greatly improved.

SOUTH SHIELDS.

The Annual Meeting of the South Shields Gas Company was held on Feb. 25. In the absence of Sir James Readhead (the Chairman) and Mr. Thomas W. Wallis (the Vice-Chairman)—both unfortunately indisposed—Mr. Henry Chapman occupied the chair. Mr. James H. Readhead, a Director, moved that a dividend be declared on the consolidated and new stocks of the Company at the rate of 4½ p.ct. (*less* income-tax) for the half-year ended Dec. 31 last, making, with the interim dividend of 4¼ p.ct. paid in August last, 8¾ p.ct. for the year; also that a dividend of 2⅞ p.ct. (*less* income-tax) for the half-year ended Dec. 31, 1929, be declared on the ordinary stock of the Company, making with the interim dividend of 2⅞ p.ct. paid in August last 5¾ p.ct. for the year. The Chairman, in moving the report and balance-sheet, said they would observe that during the past year the capital account had been increased by £1576, the expenditure being incurred in providing new meters and supply pipes to additional consumers. The sale of gas had increased by approximately 4¼ million c.ft., and the number of consumers by 376. The income from the sale of gas showed a decrease of £3617 as compared with the previous year, the decrease being more than accounted for by the fact that during the last three-quarters of the financial years the price of gas was reduced by one half-penny per therm or 2⅜d. per 1000 c.ft. This reduction in price saved the consumers the appreciable sum of £4786 during the period mentioned. The total income from all sources amounted to £131,072, as compared with £140,187 for the previous year, being a decrease of £9115, which was due to the reduction in the price of gas and the reduced income received from residual products. The total expenditure amounted to £109,414, as against £118,146 for the previous year, being a decrease of £8731, which he hoped they would consider a gratifying feature of the accounts. The profit for the year amounted to £21,657, as compared with £22,040 for the year 1928, being a decrease of £383, which, taken as a whole, he regarded as highly satisfactory, and he trusted they would endorse that opinion. It might not be out of place, continued the Chairman, to give a few figures of the progress made by the Company since the electrical assisted wiring scheme was inaugurated in South Shields. The incandescent gas burners sold and fixed in consumers' premises numbered 31,825. The number of mantles sold numbered 51,453. The number of globes sold numbered 52,793. In addition, 1752 householders had discarded electricity and returned to gas lighting, while an additional 5176 had partially returned to gas lighting and were using gas for other purposes. The number of consumers had also increased by over 3000 during the period mentioned.

SOUTHGATE.

The sale of gas by the Southgate and District Gas Company for the year shows an increase of 7·95 p.ct. as compared with that for the preceding year. After providing for interest and income-tax, &c., and transferring the sum of £2000 to reserve fund, the balance of profit available for distribution is £20,573, from which interim dividends on account of the year ended Dec. 31, 1929, declared by the Directors, were paid on Sept. 3, 1929, at the following rates—viz., on the preference stock, 5 p.ct. per annum; and on the consolidated (7 p.ct. maximum), 7 p.ct. per annum (*less* income-tax); and the Directors now recommend the declaration of final dividends for the year ended Dec. 31, 1929 (*less* income-tax) at the same rates. These appropriations (including the interim dividends) amount to £10,610, leaving £9963 to be carried to the next account.

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Mar. 7.	Rise or Fall on Week.	Transactions Lowest and Highest Prices During the Week.
£			% p.a.	% p.a.				
171,978	Stk.	Feb. 6	5	5	Aldershot 5 p.c. max. C.	73—78	..	..
522,992	,,	,,	4	4	Do. 4 p.c. Pref.	70—73	..	..
1,551,868	,,	Sept. 26	7⅞	7⅞	Alliance & Dublin Ord.	98—96	..	94½
374,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb.	60—63	..	..
522,655	,,	Mar. 6	7	7	Barnet Ord. 7 p.c.	109—112*	−3	114—115
300,000	1	Oct. 24	1/4⅛	1/4⅛	Bombay, Ltd.	16/—18/-	..	..
174,500	10	Mar. 6	9	9	Bournemouth 5 p.c.	12⅝—13½*	−½	..
500,050	10	,,	7	7	Do. B 7 p.c.	12½—12⅝*	−½	12⅝—12½
439,160	10	,,	6	6	Do. Pref. 6 p.c.	10½—11*	−¼	..
50,000	Stk.	Dec. 19	3	3	Do. 3 p.c. Deb.	53—56	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	72—75	..	..
357,900	,,	Aug. 29	7½	7½	Brighton & Hove 6 p.c. Con.	113—116	..	..
371,880	,,	,,	6½	6½	Do. 5 p.c. Con.	100—103	..	..
1,287,500	,,	Feb. 20	5	5	Bristol 5 p.c. max.	86—87*a*	..	..
855,000	,,	Sept. 12	7½	7	British Ord.	112—117	..	113
100,000	,,	Dec. 19	7	7	Do. 7 p.c. Pref.	109—114	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	69—71	..	..
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	92—95	..	..
100.000	,,	Jan. 9	5	5	Cambridge 5 p.c. Deb.	90—93	+2	..
100,000	10	Dec. 5	8	6	Cape Town, Ltd.	8½—9½	..	..
100.000	10	Nov. 7	4½	4½	Do. 4½ p.c. Pref.	6½—7½	..	..
150,000	Stk.	Dec. 19	4½	4½	Do. 4½ p.c. Deb.	69—74	..	..
626,860	,,	Feb. 20	6	6	Cardiff Con. Ord.	96—99	..	..
237,860	,,	Jan. 9	7½	7½	Do. 7½ p.c. Red. Deb.	98—101	..	..
157,150	,,	Feb. 20	5	6½	Chester 5 p.c. Ord.	87½—92½*b*	..	..
98,936	1	Oct. 10	†2/-	†2/-	Colombo, Ltd. Ord.	34/—36/-	..	..
24.495	1	,,	1/4⅛	1/4⅛	Do. 7 p.c. Pref.	19/—21/-	..	..
375,402	1	Oct. 10	1/9½	1/9½	Colonial Gas Assn. Ld. Ord.	20/6—22/6	..	..
187,848	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	..
2,073,280	Stk.	Feb. 20	5	7	Commercial Ord.	87—92*	..	87—88⅞
475,000	,,	Dec. 19	3	3	Do. 3 p.c. Deb.	54—57	..	54½
787,560	,,	Feb. 20	7	7	Croydon sliding scale.	102—105	..	..
453,100	,,	,,	5	5	Do. max. div.	80—83	+1	82—83
542.270	,,	Mar. 6	7	10	Derby Con.	1'5—125*e*	−2½	..
55,000	,,	Dec. 19	4	4	Do. Deb.	67—70*e*	..	..
209.000	,,	Mar. 6	5	5	East Hull Ord. 5 p.c.	71—73*	−2	..
1,002,180	10	Sept. 12	†7	†4	European, Ltd.	12½—13½	..	£12/15/6—13⅜
18,629,125	Stk.	Feb. 20	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	17/4½—17/10½*f*	..	17/4½—17/9
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	60½—62½	+½	62 - 62½
4,157,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	75—78	..	76½
5,602,620	,,	Dec. 19	3	3	Do. 3 p.c. Con. Deb.	56—59	..	56½—58
2,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	97—100	..	99⅜
82,500	,,	Aug. 29	7	7	Hastings & St. L. 5 p.c. Conv.	98—103	..	..
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	78—83	..	79½
70,000	10	Oct. 10	†10	†10	Hongkong & China, Ltd.	13⅜—14⅜	..	..
213,200	Stk.	Mar. 6	6	6	Hornsey Con. 3½ p.c.	90—93*	..	..
1,976,000	,,	Nov. 1	20	10	Imperial Continental Cap.	350—370	−10	353 - 363
223,130	,,	Feb. 6	3½	3½	Do. 3½ p.c. Red. Deb.	70—75	..	..
285,242	,,	Aug. 15	8	8½	Lea Bridge 5 p.c. Ord.	115—118	..	..
2,145,907	,,	Feb. 20	6	6	Liverpool 5 p.c. Ord.	88½—89½*b*	−½	..
600,000	,,	Sept. 26	7	7	Do. 7 p.c. Red. Pref.	100½—102½*b*	..	..
165,736	,,	Feb. 20	9	8	Maidstone 5 p.c. Cap.	119—124*	..	..
68,480	,,	Dec. 19	3	3	Do. 3 p.c. Deb.	52—55	..	..
75,000	5	Dec. 5	†10	†10	Malta & Mediterranean Metrop'itan (of Melbourne)	5½—6	..	..
392,000	—	Oct. 1	5½	5½	5½ p.c. Red. Deb.	92—95	..	..
541,920	Stk.	Nov. 21	†9	†6	Montevideo, Ltd.	107—112	..	109—110½
2,061,315	,,	Feb. 20	5	5½	Newcastle & Gateshead Con.	15/9—16/3*d*†	−/6	..
682,856	,,	,,	4	4	Do. 4 p.c. Pref.	70½—71½*d**	..	..
691,705	,,	Dec. 19	3½	3½	Do. 3½ p.c. Deb.	66½—67½*d*	..	..
169,940	,,	Mar. 6	7½	7½	North Middlesex 6 p.c. Con.	109—114*	−3	112½—115
326,160	,,	Feb. 6	5	5	Northampton 5 p.c. max.	74—77	..	..
300,000	,,	Nov. 21	7	9	Oriental, Ltd.	108—113	..	..
60,000	5	13 My., '15	—	—	Ottoman	0—¼	..	..
205,162	Stk.	Jan. 9	8	8	Plym'th & Stonehouse 5 p.c.	107—110	..	..
424,416	,,	Feb. 20	8	8	Portsm'th Con. Stk. 4 p.c. Std	110—115	..	..
241,446	,,	,,	5	5	Do. 5 p.c. max.	78—81	..	..
2,334,464	1	June 27	—	15	Primitiva Ord.	27/—29/-	..	..
244,500	100	Dec. 2	4	4	Do. 4 p.c. Red. Deb.	92—95	..	..
695,000	Stk.	Jan. 23	4	4	Do. 4 p.c. Red. Deb. 1911	77—80	..	79½
416,345	,,	Dec. 19	4	4	Do. 4 p.c. Cons. Deb.	77—80	..	..
150,000	10	Sept. 26	6	6	San Paulo 6 p.c. Pref.	8½—9½	..	..
1,736,968	Stk.	Aug. 29	6½	6½	Sheffield Cons.	105—107*e*	..	..
95,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb.	76—78*e*	..	..
90.000	10	June 13	‡4	‡4	South African	4—6	..	..
6,709,895	Stk.	Feb. 20	5	7½	South Met. Ord.	97—99	..	97—98½
500,000	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	106—108	..	106
1,895,445	,,	Jan. 9	3	3	Do. 3 p.c. Deb.	55—58	..	56½—57
734,000	,,	Mar. 6	6½	6½	Do. 6½ p.c. Red. Db.	97—99*	−2	..
91,500	,,	Aug. 15	8½	8½	South Shields Con.	109—111*d*	..	..
1,543,795	,,	Feb. 20	6½	6½	South Suburban Ord. 5 p.c.	98—101	..	98—100
468,837	,,	Dec. 19	5	5	Do. 5 p.c. Deb.	92—95	..	..
647,740	,,	Feb. 20	5	5	Southampton Ord. 5 p.c. max.	75—78*	..	..
121,275	,,	Dec. 19	4	4	Do. 4 p.c. Deb.	69—72	..	..
179,014	,,	Feb. 20	8	8	Sutton Ord.	113—116	..	..
67,828	,,	Jan. 9	5	5	Do. 5 p.c. Deb.	91—94	..	..
250,000	,,	Mar. 6	7	7	Swansea 7 p.c. Red. Pref.	97—99*	−3	..
200,000	,,	Dec. 19	6½	6½	Do. 6½ p.c. Red. Deb.	99—101	..	..
1,076,490	,,	Mar. 6	6½	6½	Tottenham District Ord.	99—103*	−2½	..
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	95—98*	−2	..
199,005	,,	Dec. 5	4	4	Do. 4 p.c. Deb.	70—73	..	71½—71⅞
182,380	10	30 Dec., '12	—	—	Tuscan, Ltd.	3½—4½	−¼	9⅛—4
86,701	Stk.	Sept. 26	6	6	Do. 6 p.c. Red. Deb.	75—80	..	..
309.094	,,	Mar. 6	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	94—99*	−3	..
88,336	,,	,,	5	5	Do. 5 p.c. pref.	83—88*	−2	..
1,180,970	,,	—	—	—	Wandsworth, Wimbledon, and Epsom Cons.	105—110	..	107½
200.000	,,	Feb. 20	5	5	Do. 5 p.c. Pref.	85—90	..	..
488,344	,,	Dec. 19	5	5	Do. 5 p.c. Deb.	91—95	..	92½

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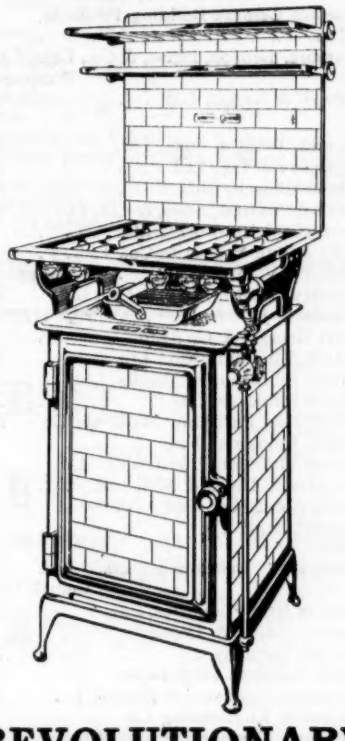

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WM. HENRY,
Town Clerk.

Town Hall,
Coleraine,
Northern Ireland,
March 4, 1930.

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(GAS DEPARTMENT.)

THE above Council are inviting Ten- ders for the Supply and Erection of Two 30 ft. square PURIFIERS, Design and Particulars of which can be obtained from the undersigned.
Tenders are to be submitted by the first post on Thursday, March 20, 1930, endorsed "Tenders for Purifiers," addressed to the Chairman of the Gas Committee, Gas-Works, Ashford, Kent.
The Council do not bind themselves to accept the lowest or any Tender.

H. R. TURNER,
Engineer and Manager.

Gas Offices,
Gas-Works,
Ashford, Kent,
March 6, 1930.

BOROUGH OF LEIGH.
(LANCS.)

THE Gas Committee are open to receive TENDERS for about 16,000 Tons of GAS NUTS and SLACK, for delivery during the Year nominally commencing April 1st next.
Further particulars and Tender Forms may be obtained from the undersigned.
Envelopes, endorsed "Gas-Works Coal," are to be addressed to T. B. Bamber, Esq., Town Clerk, Town Hall, Leigh, Lancs., and deposited not later than noon on March 20.

F. BOWEN, M.Sc.,
Engineer and Manager.

COMPANY NOTICES.

BRITISH GAS LIGHT COMPANY, LTD.

NOTICE is Hereby Given that the ANNUAL GENERAL MEETING of the Company will be held at the Chief Office, No. 2, The Abbey Garden, Westminst 1, S.W. 1, on Wednesday, the 26th of March, 1930, at 12.30 in the afternoon precisely, to receive the Report of the Directors and the Statement of Accounts for the Year ended 31st December, 1929; to Confirm the payment of the Dividend on the Preference Stock and to confirm the interim Dividend and declare a final Dividend on the Ordinary Stock; also to elect Two Directors, to appoint Two Auditors and fix their Remuneration, and to deal with any Business that may be legally transacted at an Ordinary General Meeting.
NOTICE IS HEREBY ALSO GIVEN that the TRANSFER BOOKS of the ORDINARY STOCK of the Company WILL BE CLOSED from the 12th inst. to the 26th inst.
By order of the Court of Directors,

A. J. MUMFORD,
Secretary.

Chief Office:
No. 2, The Abbey Garden,
Westminster, S.W. 1,
March 10, 1930.

PATENT NOTICES, &c.

IN THE MATTER OF LETTERS PATENT granted to FREDERICK TURNER bearing date the 12th day of August 1914 Numbered 18579 of 1914 for improvements in domestic fire grates and the like and fittings therefor.

NOTICE IS HEREBY GIVEN that on the 8th April 1930 an Originating Summons (1930 T. No. 282) issued out of the High Court of Justice (Chancery Division) on behalf of Herbert Oliver Turner and Arthur Turner the legal personal representatives of the above named Patentee asking that the term of the Patent may be extended for a further period of five years will come before Mr. Justice Luxmoore for directions as to the hearing and any person desirous of being heard in opposition must at least seven days before that date lodge notice of such opposition (giving an address for service within the United Kingdom) at Room Number 175 Royal Courts of Justice Strand London and serve a copy thereof upon the under mentioned Solicitors and upon the Solicitor for the Board of Trade.
DATED this 3rd day of March 1930.

VALLANCE & VALLANCE
20 Essex Street Strand London W.C. 2
upon whom all documents requiring service may be served.

THE Proprietors of British Patent No. 266308, for "Improvements in Means for Controlling the Supply of Gaseous Fuel and Air to the Heating Flues of Gas Retort and like Furnaces," are desirous of entering into arrangements, by way of Licence and otherwise, upon reasonable terms, for the purpose of Exploiting the Invention in this country.
All communications to LEWIS W. GOOLD & CO., 5, CORPORATION STREET, BIRMINGHAM.

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Attention is called to the eligibility for this Scholarship of graduates or other senior applicants of suitable training who desire to take a One or Two Years' Course in Gas Engineering as provided in the Regulations of the University for the Diploma or Honours Degree in Gas Engineering.
Full particulars may be obtained from THE CLERK TO THE SENATE, THE UNIVERSITY, LEEDS, to whom applications should be addressed not later than April 7th.

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